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WALLACE (J. M.) & MURPHY (A. M.). **Studies on the epidemiology of curly top in southern Idaho, with special reference to Sugar Beets and weed hosts of the vector Eutettix tenellus.**—*Tech. Bull. U.S. Dep. Agric.* 624, 46 pp., 5 figs., 1 graph, 1938.

A detailed account is given of studies conducted from 1929 to 1935 on the principal desert host plants of the beet leafhopper (*Eutettix tenellus*) in Idaho, with special reference to their reaction to curly top and their relative importance as a source of supply of the virus [*R.A.M.*, xviii, p. 223].

Tumble mustard (*Norta altissima*) appears to play an insignificant part in the provision of infective material, being extremely difficult to infect and in some way counteracting the multiplication of the virus. In a cage test, only 5 out of 841 beets exposed to leafhoppers from diseased *N. altissima* plants contracted curly top symptoms of a mild order, while field experiments gave negative results. Flixweed (*Sophia parviflora*) is susceptible to curly top, but often requires heavy inoculation at high temperatures before developing conspicuous symptoms; the virus, however, may be obtained from infected plants with no external signs of the disease. Passage through *S. parviflora* usually results in attenuation of the virus, and this host is believed to be responsible for the fact that the virus carried by desert leafhoppers is predominantly of the attenuated type. Green tansy mustard (*S. longipedicellata*) is highly susceptible both to virulent and attenuated strains of curly top, and serves as an important source of supply of infective material in the desert breeding grounds of *E. tenellus*. The curly top virus was recovered from inoculated Russian thistle (*Salsola pestifer*) plants showing no discernible symptoms of the disease. Attenuation sometimes followed passage through this host, autumn populations of the insect on which were largely non-viruliferous, indicating that *S. pestifer* is of less importance in the increase and distribution of the virus under desert conditions than in beet fields.

The viruliferous percentage of spring-brood leafhoppers varied appreciably from year to year (4 to 67 per cent.); at this stage the virus frequently consisted almost exclusively of attenuated strains, but as curly top developed in the beet fields to which the leafhoppers migrated, the latter acquired fresh supplies of virulent material and by harvest time practically 100 per cent. of the insects were viruliferous.

It was conclusively shown by experimental studies that the curly top virus can overwinter in living leafhoppers without undergoing any apparent loss of virulence. It was further found to survive under controlled conditions both in *Sophia parviflora* and *S. longipedicellata*, but the extent to which such perpetuation occurs in nature is not known. Field observations indicated that in some years leafhoppers overwintering in the cultivated areas initiate severe outbreaks of curly top. Under favourable conditions for the establishment of an epidemic sufficiently large leafhopper populations to cause heavy damage will probably reach the beet fields during the dispersal period of the insects. Among the many various factors to be considered from the epidemiological standpoint the one of most importance appears to be the stage of development of the plants at the time of leafhopper infestation. During the past 11 years there were 6 of high and 5 of low yields in the Twin Falls district, the former coinciding with a relatively late leafhopper movement (on or after 4th June) and the latter with an early migration (on or before 24th May). In this connexion the value of early planting in enabling the plants to escape the critical phase of infection is emphasized.

STIRRUP (H. H.). **Yellowing in Sugar Beet.**—*Brit. Sug. Beet Rev.*, xii, 3, pp. 77–80, 1938.

In this article the author surveys the various causes of yellowing of sugar beet [*R.A.M.*, xiv, p. 547] in England. In June and July, 1935, sugar beets received a severe check in many parts of the country owing to 'wilty yellows', which is regarded as a drought effect, a view supported by the recovery of affected plants with the advent of rains.

'Speckled yellows', confined to a few well-defined areas, is due to manganese deficiency. Affected plants have a markedly upright habit, the outer leaves are covered with star-shaped, yellow spots, and the lateral and basal margins of the affected leaves curl inwards, giving the leaves a triangular shape. The young heart leaves may also show these symptoms, but much less conspicuously. In severe attacks, affected fields can be recognized from a considerable distance by the yellowing of the foliage. On a sewage farm, where the sewage was heavily limed before being placed on the land, the P_H value of the soil rose in a few years to 8·4, with the result that mangolds and beets became severely affected with speckled yellows. On soils deficient in available manganese, speckled yellows can be prevented or cured by applying manganese sulphate at the rate of about 100 lb. per acre. In one experiment, an application at half this rate gave an increase in total sugar of 5 cwt. per acre, while one at the rate of 150 lb. per acre gave a corresponding increase of 8·1 cwt., the yield of tops also being increased. It was calculated that an expenditure of 30*s.* per acre on manganese sulphate increased the value of the crop by about £4 per acre.

No authentic case of virus yellows (or 'jaunisse') [ibid., xviii, p. 78] has so far been found in England, in spite of the most careful search.

The most prevalent form of yellowing in England is 'crackly yellows', in the early stages of which large orange or golden-yellow areas appear between the veins on the outer leaves, the leaves becoming thick and brittle, so that they crackle when squeezed in the hand. The dying parts

of the leaves are later invaded by weak parasites, which produce the large, irregular, brown patches of leaf scorch [ibid., xiv, p. 548], though, occasionally, leaves affected with crackly yellows become quite red, this symptom occurring more commonly in mangolds than beets. Unfavourable soil conditions (either too wet or too dry) appear to be an important factor in the causation of crackly yellows, while nitrogen starvation also appears to conduce to it. Observations on numerous experimental plots made over some years suggest that the condition is primarily a manifestation of nitrogen starvation in beets well supplied with other elements. The trouble was in some cases associated with hard pan.

Mosaic is the only virus disease of beet that has been recorded with certainty in England.

Brooks (C.) & McColloch (L.). **Stickiness and spotting of shelled green Lima Beans.**—*Tech. Bull. U.S. Dep. Agric.* 625, 24 pp., 4 figs., 12 graphs, 1938.

Investigations are described into two serious conditions affecting fresh Lima beans [*Phaseolus lunatus*] kept or transported after being shelled, viz., a slimy, sticky condition of the surface, and a superficial spotting consisting of spots 1 to 3 mm. in diameter, with an indefinite margin. The spots are usually brown, but under very humid conditions may become olivaceous. At first only the testa is involved, but later brown spots may form on the cotyledons.

Among the most active organisms isolated from the sticky beans and demonstrated by inoculation tests to be capable of producing stickiness were *Pseudomonas ovalis* from Virginia beans, an organism probably identical with *Achromobacter coadunatum* from California beans, and another resembling *A. lipolyticum* from Florida beans. The superficial spotting was found to be caused by *Cladosporium herbarum*. The causal organisms of both conditions occur in the soil or on decaying vegetable matter and are carried to the beans in the process of shelling.

Both troubles were diminished but not controlled by lowering the humidity of the storage atmosphere. Reducing the storage temperature to 41° F. checked both conditions for six to seven days or more, and this period was increased to 10 to 14 days by a further reduction to 32°. Keeping the beans in an atmosphere containing at least 25 per cent. of carbon dioxide had an inhibiting effect on the stickiness equivalent to that of a reduction in temperature of 18° and an even more marked effect on the spotting, with no adverse effect on flavour. Washing the beans in a 30 per cent. solution of ethyl alcohol or the pods in a 4 per cent. solution of chlorinated lime completely controlled spotting and gave good commercial control of stickiness.

Anliker (J.). **Infektionsversuche an Schnittlauch (Allium schoenoprasum L.) mit Fusarium vasinfectum Atk. var. zonatum (Sherb.) und Fusarium avenaceum (Fr.) Sacc.** [Infection experiments on Chives (*Allium schoenoprasum* L.) with *Fusarium vasinfectum* Atk. var. *zonatum* (Sherb.) and *F. avenaceum* (Fr.) Sacc.]—*Phytopath. Z.*, xi, 4, pp. 439–446, 3 figs., 1938.

Fusarium vasinfectum var. *zonatum* f. 1 [*R.A.M.*, xvi, p. 440] and *F. avenaceum* were isolated from chive plants (also attacked by eelworms)

obtained from a Zürich nursery in 1936. This host has hitherto been regarded as immune from attack by *Fusarium*, and in order to ascertain the cause of the disease inoculation experiments were carried out with the two species isolated. Plots artificially infected with *F. vasinfectum* var. *zonatum* f. 1 yielded an average of 26 per cent. fewer plants than the controls, and caused a reduction in the air-dry weight of about 32 per cent. Plots artificially infected with *F. avenaceum* yielded 50 per cent. fewer plants than the controls, but simultaneous infection with both fungi did not result in greater damage and did not exceed the results obtained with *F. vasinfectum* var. *zonatum* f. 1 alone. Septate and non-septate mycelium was found in the tissue of all parts of numerous infected plants, and the two species of *Fusarium* used for the artificial infections were reisolated.

SEMPIO (C.). **Sulla maggiore sensibilità di piante infette al momento della sporificazione del parassita (nota preventiva).** [On the greater sensitivity of diseased plants at the time of sporulation of the parasite (preliminary note).]—*Riv. Pat. veg.*, xxviii, 9–10, pp. 393–397, 2 figs., 1938.

In further studies on the influence of environmental factors on infection [*R.A.M.*, xviii, p. 48] the author inoculated 15-day-old Gotta lettuces with an aqueous suspension of the conidia of *Bremia lactucae* [*R.A.M.*, xviii, p. 7], one series of pots being placed in the dark for six days from the commencement of infection, a second treated similarly from the seventh day after inoculation until the end of the ninth day, and a third retained in the light as a control.

Ten or eleven days after inoculation, the controls and the seedlings placed in darkness on the day of inoculation showed the usual symptoms of infection, whereas those placed in darkness on the seventh day showed flaccid, rolled, necrotic leaves. Repeated experiments invariably confirmed this result, and it is concluded that in the disease in question the period preceding the emission of the conidiophores is a highly critical one, in which the host-parasite relationship is definitely and characteristically upset by unfavourable environmental conditions normally exerting no adverse effect. Analogous results were obtained with radish infected with *Cystopus candidus* and Rieti wheat infected with *Erysiphe graminis* [ibid., xviii, p. 166], but the plants placed in darkness on the seventh day showed yellowing without wilting or necrosis.

WHITE (H. L.). **The sterilization of Lettuce seed.**—*Ann. appl. Biol.*, xxv, 4, pp. 767–780, 1 pl., 7 graphs, 1938.

Full details are given of experiments on the sterilization of lettuce seed by calcium hypochlorite (bleaching powder), preliminary accounts of which have been already noticed from other sources [*R.A.M.*, xiii, p. 676; xiv, p. 673]. Preparations of bleaching powder differ considerably in chemical activity, and before sterilizing large quantities of seed a preliminary test should be made of its effect on the germination of a small sample. Preparations containing mercury, such as the organic mercurial dusts, are highly toxic to lettuce seed, the germination of which was stimulated by treatment with calcium hypochlorite.

Cook (M. T.). **Cucumber mosaic in Puerto Rico.**—*J. Agric. P.R.*, xxii, 3, pp. 443–447, 1 pl., 1938.

In histological studies on cucumber mosaic [*R.A.M.*, xvii, p. 299] the author found that in most instances the mosaic leaves and mosaic parts of leaves were thinner than normal leaves and normal parts of leaves. The palisade cells in the mosaic areas were invariably shorter than normal and occasionally they remained undeveloped and cuboidal. The chloroplasts were more numerous and generally larger in the normal than in the mosaic parts. There was little, if any, difference in the size of the palisade cells in the chlorotic and green areas of the fruits, but fewer chloroplasts were noted in the chlorotic cells than in the green areas.

Pizer (N. H.) & Thompson (A. J.). **Investigations into the environment and nutrition of the cultivated Mushroom (Psalliota campestris). II. The effect of calcium and phosphate on growth and productivity.** —*J. agric. Sci.*, xxviii, 4, pp. 604–617, 1938.

In further studies on the environment and nutrition of *Psalliota campestris* [*R.A.M.*, xvii, p. 11], the mushrooms were grown (in houses during summer) in composts made from fresh horse manure and wheat-straw bedding to which was added commercial flake calcium chloride, ground gypsum, superphosphate of lime, and hydrated lime (the last in error for ground carbonate of lime) containing, respectively, 26, 24, 21, and 53 per cent. calcium, the most suitable rate being taken as that providing 0·5 part of calcium per 100 parts of dry compost by weight. All these materials, except hydrated lime, promoted mycelial growth in laboratory trials. To all the composts a soluble phosphate was also added in amounts equivalent to 0·031 gm. of phosphorus per 100 gm. of dry compost. Experiments were laid down so that the effect of superphosphate on yield could be examined statistically; ammonium sulphate was added to some of the plots in addition to superphosphate, as in laboratory tests it had resulted in improved mycelial growth.

The data obtained showed definitely that on some kinds of manure mycelium does not grow properly unless a calcium compound is added. Hydrated lime was found to be markedly deleterious as it makes the compost too alkaline even when used in small amounts. Calcium carbonate was less effective in laboratory experiments than calcium chloride, or sulphate, or acid phosphate. Calcium chloride is one of the best flocculants but may increase the osmotic pressure unduly in composts containing a high proportion of soluble matter. In one experiment in which calcium chloride was used freshly cut mushroom tissue rapidly turned brown, possibly owing to the chloride ion. Superphosphate flocculates manure very readily since it is moderately soluble and the effect of small amounts of superphosphate in lowering the P_H value of the composts was not harmful. The influence of superphosphate on mycelial growth largely results from the action of calcium on the compost and from that of the phosphate ion, which seems to increase the number and thickness of the hyphae. In a majority of the tests superphosphate gave earlier cropping and more numerous buttons; additions of 5 to 9 lb. per ton of fresh manure increased yields, while larger

amounts appeared to reduce them. Growers have reported that the addition of superphosphate sometimes increased the yield, but in others cropping finished earlier and the yield was not so good. In view of these results superphosphate should be employed only to supply phosphate, and not as a flocculating agent. On manure giving unsatisfactory results it is most readily applied mixed with gypsum, 28 lb. of a mixture containing not over 7 lb. of superphosphate replacing the second gypsum application.

Ground gypsum was the most satisfactory flocculating agent tested. It is effective in alkaline and acid conditions, and as its maximum solubility in water is very low, large applications do not affect the osmotic pressure. It supplies sulphate, which may be valuable as a nutrient; it has, apparently, no adverse effect on mushroom metabolism; and it is inexpensive and easily obtained. It invariably gave vigorous growth and normal cropping in all the quantities in which it was used (22·5 to 56 lb. per ton of fresh manure). In practice, 28 lb. per ton of fresh manure is a suitable quantity to apply. It should be applied as early as possible in order to avoid uneven flocculation. Following the recommendation of the first-named author [ibid., xvi, p. 585] gypsum is now widely used by growers, most of whom find it produces more reliable composts, but a few consider it is unnecessary.

The physico-chemical changes resulting from the presence of calcium are of great value during fermentation. The ability of the colloids to take up and hold water is increased, and the flocculated manure has a more rigid, granular structure. Drainage and aeration are improved, and much more water can safely be added without the manure becoming sodden and compacted. Aerobic fermentation is favoured, and the products of anaerobic fermentation appear to be less. With larger amounts of water in the manure and improved aeration, chemical changes occur more quickly, and the manure composts sooner. The final compost is a uniform product of good physical condition free from unpleasant odour.

The value of gypsum appears to be due to changes produced by calcium ions in the physico-chemical condition of the manure, flocculation being the most apparent. Flocculation induced improved aeration, which may be partly the cause of better mycelial growth; in instances of failure remedied by flocculation, however, mycelial growth is no better on the surface of the manure than in it, and sometimes does not take place at all. The new surfaces formed during flocculation may possibly assist reactions on the hyphae or by enzymes secreted by them, for the structure, composition, and energy of surfaces and the rates of diffusion across them play important parts in enzyme reactions.

Storey (H. H.) & Nichols (R. F. W.). **Studies of the mosaic of Cassava.**—*Ann. appl. Biol.*, xxv, 4, pp. 790–806, 2 pl., 1 fig., 1938.

On the basis of studies on cassava mosaic [*R.A.M.*, xvii, p. 724] in plants of a single clone, all grown under identical conditions at Amani, Tanganyika, the authors were able to divide the symptoms into two well-defined groups, produced by the severe and the mild strains of the virus, the former characterized by severe chlorosis with usually large, more or less uniformly distributed, but sometimes localized, yellow or

nearly white chlorotic areas, and the latter, often quite symptomless, characterized by slight chlorosis with small, either generally distributed or localized chlorotic areas, only slightly paler than normal. Transmission of the virus by grafting has been used by the authors for several years as a routine technique with consistent success. Apparently healthy plants have sometimes developed from cuttings from a diseased plant, and occasionally a cutting has produced a healthy plant, while other parts of the same stem from above and below the cutting have produced diseased plants, so that the virus is apparently not always fully systemic. Attempts to transmit the virus by needle scratch and puncture, by rubbing young leaflets, or by hypodermic injections gave negative results; the insects *Erythroneura cassavae* and *Penthimia bella*, bred successfully on cassava, also failed to transmit the virus in a limited series of trials. Both the severe and mild groups of the virus were successfully transmitted by a species of *Bemisia* referred to *B. gossypiperda* by Karam Singh and to *B. nigeriensis* by G. H. Corbett, while a field collection was determined by J. Ghesquière as *B. gossypiperda* var. *mosaicivectura*. It remains doubtful, therefore, whether the virus of cassava mosaic is transmitted by one or several species of *Bemisia*. In transmission experiments, in which large numbers of insects were used, the vector was capable of inoculating the plant successfully only through immature leaves which had reached about one-quarter of their full length. The virus passed from the leaf into the stem about eight days after inoculation, and rapidly advanced to the base of the stem, but only slowly moved into side branches or into other stems arising from the same cutting. A new transmission technique, entailing the enclosure of a quarter-grown single leaf in a glass tube into which the insects are blown from a pipette, was evolved in the course of these experiments and found to be economical and reliable. Infection with a mild strain did not confer immunity from severe strains introduced by grafting, but when the severe strains were inoculated by insects some degree of induced resistance was manifest; field trials, however, showed that this strain does not afford a practical means of protection.

Du Plessis (S. J.). **The occurrence of the dead-arm disease of Vines in South Africa.**—*Sci. Bull. Dep. Agric. S. Afr.* 175, 9 pp., 7 figs., 1938.

In this expanded account of investigations since 1935 into dead arm disease of the vine in South Africa the author states that the perfect stage of the causal organism (*Cryptosporella viticola*) [*R.A.M.*, xvii, p. 499] has not been found locally, while the conidial stage, *Fusicoccum viticolum*, was isolated from lesions on the shoots, and gave positive results in inoculation tests. *F. viticolum* was also found on old, decaying shoots in the vineyard, but it appears to sporulate less abundantly in South Africa than in the United States. Infection seldom leads to the death of the major parts of the vines and of the bunches, owing to the dry conditions prevailing during summer in the winter-rainfall area of Cape Province. It does not appear that the disease is likely to become very serious in South Africa. The Cabernet, Barlinka, and Red Hanepoot vine varieties are only moderately susceptible.

Du Plessis (S. J.). **Further studies on the control of Botrytis rot in Grapes.**—*Sci. Bull. Dep. Agric. S. Afr.* 166, 9 pp., 7 figs., 1938.

This is an expanded account of work already noticed from another source [*R.A.M.*, xvii, p. 499]. Infection by *Botrytis cinerea* was more severe in unwrapped than in wrapped grapes, in grapes packed in a slanting position than in those packed flat, and in grapes packed with corrugated paper linings to the boxes than in those packed with wood wool.

Vasiliu (H.), Huber (Z.), Pântea (C.), & Timoșencu (A.). **The presence of copper in the soil of vineyards, its influence, and the influence of copper in general on plant growth. The influence of copper on plant development.**—*Bul. Fac. Şti. agric. Chişinău, Comun. Lab. Chim. agric.*, i, 3, pp. 49–61, 1937; ii, 1, pp. 71–76, 1938. [Rumanian. Abs. in *Chem. Abstr.*, xxxii, 22, p. 9366, 1938.]

Considerable amounts of copper are stated to accumulate in the soil of Rumanian vineyards as a result of spraying [against *Plasmopara viticola*: cf. *R.A.M.*, xiv, p. 244], and analyses showed that a portion is absorbed by the plants growing in the vicinity. Lundegârdh's method [ibid., iv, p. 104] was used to determine the effect of the metal on plant growth, especially spring wheat and maize, which were found to benefit by small quantities of copper, whereas large amounts produced a toxic effect. In a further series of experiments with maize the addition of ammonium sulphate to soil treated with various amounts of copper sulphate was found to increase the dry substance of the plants by up to 50 per cent., whereas without the ammonium sulphate the copper exerted no influence whatever, since enough was already in the soil to suffice for the smaller development of the plants.

1er Congrès des Microbiologistes de langue française (Paris, 27, 28 et 29 octobre 1938). [First Congress of French-speaking microbiologists (Paris, 27th, 28th, and 29th October, 1938).]—*Ann. Inst. Pasteur*, lxi, 6, pp. 756–882, 1938.

Among the papers contributed to the first congress of French-speaking microbiologists held in Paris from 27th to 29th October, 1938, the following contain references to matters of phytopathological interest.

W. H. Schopfer briefly discusses (pp. 779–780) the phenomenon of symbiosis in relation to growth-promoting factors, as exemplified by the joint development in a synthetic culture medium (insufficient for either alone) of *Rhodotorula rubra* and *Mucor ramannianus*, each of which supplies the other with the requisite elements [cf. *R.A.M.*, xviii, p. 198]. A second short paper (pp. 781–782) by the same author treats of the specific action of aneurin [vitamin B_1] and a homologue of this substance on various fungi, including *Ustilago violacea* [ibid., xviii, p. 185].

S. Métalnikov summarizes (pp. 826–827) the successful results of his experiments in the control of various crop pests by means of the application of dried bacterial spore emulsions, with special reference to work conducted along these lines in 1937 against vine insects in France [ibid., xvii, p. 35].

J. Comandon and P. de Fonbrune give some further details (pp. 842–844) of the mechanism of the various kinds of 'traps' and 'snares' elaborated by nematode-destroying fungi [see below, p. 251].

A. Gratia sums up (pp. 845–852) the results of recent outstanding contributions to the problem of ultramicroscopic viruses.

P. Manil draws attention (pp. 858–860) to the extreme heterogeneity in respect of various important characters (thermal death point, dilution tolerance, reaction to antiseptics, and antigenic properties) of a number of plant viruses.

J. Dufrénoy briefly describes (pp. 876–878) an experiment in which virus Y-free stocks of Up-to-Date and Arran Banner potatoes from Eire, cultivated in a mountain reserve of the French Pyrenees in proximity to infected indigenous varieties and consequently visited by *Myzus persicae*, contracted the typical perivascular necroses caused by this virus, whereas similar material grown in an isolated field remained healthy. The average weights (in gm.) of the tubers produced per plant by Up-to-Date were as follows: isolated site and three infested fields, 1,018, 825, 577, and 615, respectively, the corresponding figures for Arran Banner being 673, 554, 489, and 436, and for the indigenous varieties 745, 715, 715, and 646, respectively [cf. ibid., xvii, p. 833].

NARASIMHAN (M. J.). **Annual report of the Mycological Department for the year 1936–37.**—*Adm. Rep. agric. Dep. Mysore, 1936–37*, pp. 169–173, 1938.

The following are among the items of interest in this report [cf. *R.A.M.*, xvi, p. 154]. Koleroga disease (*Phytophthora arecae*) of areca nut was virulent, especially in the Thirthahalli district, as the heavy monsoon throughout the year did not permit spraying. Gardeners round Yedur who closely followed the spraying recommendations of the Department and finished spraying before the beginning of the monsoon, and sprayed a second time when the nuts were well developed, made their crops absolutely safe, whereas a number of others, who postponed spraying, lost the major portion of their crops, since there was no break in the monsoon to allow of treatment.

A fungus resembling *Cephalosporium* [ibid., xviii, p. 89] was isolated from the root-stocks of cardamom [*Amomum subulatum*] from a garden at Uchangi, the same fungus as has been reported to be associated with the so-called 'phurki' disease [loc. cit.] of the greater cardamom [*Elletaria cardamomum*] in the Darjeeling district in India, although even there its pathogenic nature has not been proved. The 'katte roga' disease of cardamom, causing on the leaves streaks or stripes, which later fuse together, was studied on a number of estates, where different kinds of leaf spots and mosaic were also observed.

Pure cultures of *Pestalozzia psidii* and a *Gloeosporium* [ibid., iii, p. 701] were obtained from isolations from the diseased fruits of guava [*Psidium guajava*] showing the characteristic spots. Inoculations of wounded or unwounded unripe fruits with spores of the two fungi were unsuccessful. Spraying guava trees at Hebbal with 1 per cent. Bordeaux at an advanced stage of infection failed to control *P. psidii*, whereas the same spray in a garden near Bangalore at an early stage of infection was very effective.

The perfect stage of *Sclerotium rolfsii* causing the pseudostem rot of plantains was obtained on onion agar in Petri dishes and test-tubes in about two months.

A species of *Colletotrichum* [cf. ibid., xiv, p. 718] isolated from betel vines [*Piper betle*] affected with the 'karijali roga' disease developed perithecia in culture. This disease is characterized by blackish spots on the leaves and vines, the latter drying up with the withering of the foliage and even collapsing in cases of severe infection.

About 100 lime trees attacked by *Pseudomonas citri* [ibid., xiii, p. 160; xvii, p. 520] at Gunjur were effectively protected by 1 per cent. Bordeaux.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 12, pp. 669–673, 5 figs., 1938.

To secure control of tomato bacterial canker (*Aplanobacter michiganense*) [*R.A.M.*, xvii, p. 376] in New South Wales, growers are advised to obtain their seed only from crops completely free from canker and *Fusarium* wilt [*F. bulbigenum* var. *lycopersici*: ibid., xvii, p. 588]. In addition, the seed should be extracted by fermentation with the pulp, without water, for not less than three days, and should be disinfected with mercuric chloride (1 oz. per 6¼ gals. water). The position of the seed-beds should be changed annually, and the soil treated with formalin. Infested land should not be planted to tomatoes for three years; in glasshouses steam sterilization should be used.

To secure adequate control of passion fruit [*Passiflora edulis*] brown spot (*Alternaria* [*passiflorae*: ibid., xvii, p. 695]), the vines should be pruned at least once a year, and sprayed with Bordeaux mixture (6–4–50) at intervals of about a month during spring and summer and of two months during the remainder of the year. The spray must reach the inner portions of the vines.

In seed treatment against China aster [*Callistephus chinensis*] wilt (*Fusarium conglutinans* [var.] *callistephi*) [ibid., xvii, p. 297] the best results are given by pre-soaking in water for 30 minutes, followed by immersion for the same period in mercuric chloride (1 oz. to 6¼ gals. water); after this, the seed is washed for 5 minutes in running water, drained, and spread out to dry for 24 hours.

The best precaution against cabbage downy mildew (*Peronospora parasitica*) is to spray the plants in the seed-bed with Bordeaux mixture (1–1–10) plus a spreader or sticker, directly the first leaves begin to develop and then weekly until the plants are set in the field. All spotted heads should be rejected at harvesting. In addition, crop rotation is necessary, and the plants must not be grown too thickly or kept too wet in the seed bed.

Twelfth Annual Report of the Department of Scientific and Industrial Research, New Zealand, 1937–38.—128 pp., 1938.

G. H. CUNNINGHAM, on pp. 21–23 of this report, states that investigations of the Plant Diseases Division have demonstrated that *Phoma lingam* [*R.A.M.*, xviii, p. 222] may persist in infected soil for two seasons. Soft rot disease of swedes and turnips was found to be due to *Bacillus* [*Pseudomonas*] *campestris* [ibid., xvii, p. 29] and *B.* [*Erwinia*] *melonis* [ibid., xi, p. 344], entry being effected through injuries, generally leaf scars, and facilitated by animal injuries or previous attack by virus disease. Wart cress (*Cardamine heterophylla*) and wallflower were found to be additional hosts of turnip mosaic [ibid., xviii, p. 223].

Halo blight of oats (*Bacterium coronafaciens*) [ibid., xvi, p. 310] occurred in two localities.

Mosaic of runner and dwarf beans [*Phaseolus vulgaris*] was due, apparently, to bean virus 1, 30 per cent. of the seed from mosaic plants being affected [ibid., xvi, p. 295; and see below, p. 288]. Of 33 garden and 10 field varieties of peas, 11 and 1, respectively, were immune from mosaic (pea virus 2) [ibid., xvii, p. 126].

A disease of field and glasshouse tomatoes previously confused with *Verticillium* wilt [*V. albo-atrum*] was caused by *Aplanobacter michiganense*. The host range of tomato spotted wilt in New Zealand [ibid., xvi, p. 714] was extended to include 21 species in 7 families; lettuces were seriously affected in one locality.

Passion fruit [*Passiflora edulis*] grease spot was caused by an organism which is stated to have been named *Phytomonas passiflorae*, and brown spot of the same host by *Alternaria passiflorae* [see preceding abstract].

The tobacco mosaic virus (tobacco virus 1), which may be spread by smokers to plants in the field, was destroyed in smoking tobacco without impairment of flavour by autoclaving for 15 minutes at 10 lb. pressure.

In the sections of this report dealing with fruit research and cold storage (pp. 40–49) it is stated that the application of Bordeaux mixture (1½–3–50) early in January, before any sign of infection had appeared, gave satisfactory control of bitter rot of apples (*Glomerella cingulata*).

A scheme for the certification of fungicides, inaugurated and controlled by the Plant Diseases Division, is now in operation, and two certification lists covering orchard sprays have been issued.

When Cox's Orange Pippin apples were taken from sunny and well-shaded parts of the trees (two pickings being made), on arrival in London storage pit was practically the only form of wastage found. The condition increased appreciably during the three weeks following discharge, while much breakdown and some fungal infection developed in the second picking. In both shipments pit was much more severe in the fruit from the shaded than in that from the sunny parts of the trees; it was less severe in the second than the first picking.

Experimental evidence showed that the use of oiled wrappers did not improve the keeping quality or general appearance of Cox's Orange Pippin, Jonathan, Dunn's Favourite, Wolseley, Ballarat, Statesman, Sturmer Pippin, Delicious, or Dougherty apples, but did reduce superficial scald in Granny Smith and Rome Beauty apples. Further storage trials with Granny Smith apples also showed that the locality of the orchard is a significant factor in the development of superficial scald, that the less mature fruit becomes affected earlier than the more mature, and that fruit cooled almost immediately after picking develops more discoloration than fruit whose storage is delayed.

After two months' storage, Cox's Orange Pippin apples from trees receiving ammonium sulphate developed a high percentage of internal breakdown, as compared with fruit from untreated trees or trees given phosphate-potash applications. The use of phosphate and potash in addition to the nitrogen halved the incidence of breakdown. None of the treatments had any effect on storage pit. The increase in susceptibility to breakdown induced in Dunn's Favourite apples by applications

of 2 or 4 lb. of ammonium sulphate per tree in time became less, though still apparent. With Jonathan apples, applications of 2 and 4 lb. ammonium sulphate in addition to normal phosphate and potash continued to give marked and proportionate increases in susceptibility to breakdown and fungal infection. Jonathan spot was unaffected by nitrogen treatments. Potash reduced breakdown and fungal incidence, but markedly increased Jonathan spot and induced a slight amount of deep scald. On the Sturmer variety nitrogen by itself gave a relatively high percentage of breakdown and fungal disease, this adverse effect being, however, reduced by the use of phosphate in addition to the nitrogen, while phosphate plus potash eliminated it completely. Potash applied at various rates reduced breakdown and fungal infection in Sturmers, but storage pit was unaffected by different treatments.

Division of Plant Pathology.—*Rep. N.Y. St. agric. Exp. Sta., 1937–38*, pp. 22–24, 1938.

Evidence obtained in New York State has shown that in the control of apple scab [*Venturia inaequalis*: *R.A.M.*, xvii, p. 118] lime-sulphur should be employed only as an eradicant, while for preventive purposes wettable sulphurs are equally effective. Bordeaux mixture and its substitutes should have no part in the spray programme except as summer or cover sprays. Orthex is highly valuable when used with sulphurs that it flocculates, since it enables the spray to be applied during rain, and allows the concentration of the fungicide to be materially reduced. The carry-over of infection in badly diseased orchards may be practically eliminated by applications of liquid fertilizers in early spring.

Flotation sulphur with orthex gave better results against cherry leaf spot [*Coccomyces hiemalis*: see below, p. 261] than lime-sulphur; wettable sulphurs did not give adequate control. Bordeaux mixture should be used against this disease after picking.

Eradication methods, as used in western New York, against raspberry mosaic, appear to be unavailing in the Hudson Valley. In resistance tests the Marcy, Indian Summer, and 20 seedling red raspberry varieties have remained free from the disease in experimental plantings [ibid., xvii, p. 377].

The seed treatment of peas with red copper oxide continues to increase, 110,000 bushels being treated in 1938. Evidence was obtained that the material may cause injury if fertilizer is sown with the peas; it should not be used when the seed is to be planted in acid soils. Spraying with red copper oxide against damping-off of peas should be carried out before transplanting.

Hop downy mildew [*Pseudoperonospora humuli*] was effectively controlled by Bordeaux mixture (4–2–50); the spray increased the yield by from 30 to 100 per cent., and gave more mature hops of better quality. Selection of healthy propagating material controlled hop 'slip down' [ibid., xvii, p. 377].

Higgins (B. B.). **Botany.**—*Rep. Ga agric. Exp. Sta., 1937–38*, pp. 54–62, 3 figs., 1938.

Spanish groundnuts growing in Georgia, and treated by sulphur-dusting against leaf spot (*Mycosphaerella arachidicola* and *M. berkeleyii*)

[*R.A.M.*, xvii, p. 651] retained their leaves up to maturity and gave an increase in yield of 5 to 77 per cent. (average 18 per cent.) over the undusted controls; not all the increased yield was, however, attributable to disease control.

Mycosphaerella pinodes and *Ascochyta pinodella* [ibid., xvi, p. 435; xvii, p. 645] were isolated from fragments of Austrian Winter pea stems found in the field in September, showing that these fungi can live over from spring until autumn in old, diseased stems left on the ground, and so provide inoculum for the new crop sown in autumn. In one test, *A. pinodella* was isolated from old, dry pea stems kept in the laboratory for 13 months. Preliminary tests indicated that rotation is at present the most promising means of controlling pea leaf blotch (*Septoria pisi*) [ibid., xi, p. 222].

Report of the Michigan Agricultural Experiment Station for the two years ended June 30, 1938.—48 pp., 1938.

This report [cf. *R.A.M.*, xvi, p. 157] contains the following items of phytopathological interest. In field trials with several copper compounds (oxobordo 3–50, coposil 2–50, copper hydro 40 4–50, cupro 3–50, basicop 4–50 [ibid., xvii, p. 608], high calcium lime Bordeaux, magnesium lime Bordeaux, and calcium and magnesium limes alone) in the control of early blight of potatoes [*Alternaria solani*: ibid., xvii, p. 836], only the two Bordeaux mixtures were effective, showing 8·3 and 10·1 per cent. of infection, respectively, and reducing leafhopper injury from 98 per cent. in the untreated control to 5 per cent. The other copper compounds only reduced infection from 55 to 21 per cent. below that of the control.

In field tests of the reaction of tomato varieties to wilt [*Fusarium bulbigenum* var. *lycopersici*: ibid., xvii, p. 419] the varieties New York State, John Baer, Prairiana, Rutgers, Penn State, Illinois Baltimore, Illinois Pride, Early Baltimore, Michigan State Forcing, Kanora, Marglobe, and Pritchard showed 86, 82, 71, 67, 61, 61, 52, 33, 22, 19, 0, and 9 per cent. infection, respectively. In field and greenhouse trials strains of some of these varieties showed striking differences in their susceptibility to wilt; thus, while John Baer showed 82 per cent., one of the Station's selections of the same variety showed only 19 per cent. infection.

Fawcett (G. L.). **Departamento de Botánica y Fitopatología.** *Ex* **Memoria anual del año 1937.** [Department of Botany and Phytopathology. *Ex* Annual Report for the year 1937.]—*Rev. industr. agríc. Tucumán*, xxviii, 1–3, pp. 45–48, 1938.

The following are among the references of phytopathological interest in this report [cf. *R.A.M.*, xiii, p. 685]. Red rot of sugar-cane [*Colletotrichum falcatum*] was not detected in any of the samples examined during 1937. The same crop suffers from two forms of chlorosis, one confined to young cane during the spring and curable by applications of ammonium sulphate to the soil, and the other of obscure origin, persisting much longer and not amenable to control by manurial treatment. Experiments have shown that the latter disorder is in all

probability non-infectious [cf. ibid., xii, p. 10], and it also does not appear to be due, under Argentine conditions, to excess of sodium carbonate, as suggested by Tempany in the West Indies (*W. Ind. Bull.*, p. 149, 1917).

Melanosis of citrus [*Diaporthe citri*: ibid., xvii, p. 595] was observed for the first time in Tucumán, chiefly affecting grapefruit.

Curly top is prevalent among sugar and fodder beets, which are also affected by a more serious disease, presumably of virus origin, characterized by the sudden abnormal growth of all the basal leaf buds and resulting in the death of the plants during the spring.

Verona (O.) & Paganini (M. L.). **Influenza esercitata da alcuni ormoni animali sopra lo sviluppo generale di piantine di Ricino e la formazione di tumori sperimentali da 'Bacterium tumefaciens' S. et T.** [The influence exerted by some animal hormones on the general development of Castor Oil plants and the formation of experimental tumours by *Bacterium tumefaciens* S. & T.]—*Arch. Ist. biochim. ital.*, x, 3, pp. 319–324, 1938. [Spanish, Portuguese, German, English, and French summaries.]

A tabulated account is given of the writers' experiments at the Pisa Phytopathological Institute on the action of various animal hormones on the growth of castor oil (*Ricinus*) [*communis*] plants and the development thereon of crown gall (*Bacterium tumefaciens*) tumours [*R.A.M.*, xvii, p. 661]. Thyroid, suprarenal, pituitary, and ovarian follicle extracts were introduced into the seedlings shortly after germination, and inoculation with *Bact. tumefaciens* followed when the first leaf was produced. The treatment noticeably retarded the growth of the plants but did not appreciably affect the development of the tumours.

Montemartini (L.). **Il Bacterium tumefaciens.** [*Bacterium tumefaciens.*]—*Boll. Ist. sieroter. Milano*, xviii, pp. 551–588, 1938. [Abs. in *Ber. wiss. Biol.*, xlix, 4–5, p. 277, 1939.]

This is stated to be a detailed account of all previous observations, interpretations, and records of *Bacterium tumefaciens*, and is furnished with a bibliography of some 500 entries. The identification and properties of the organism are discussed, the symptoms produced on its hosts described, and lists given of susceptible and resistant plants. The geographical distribution of the pathogen is traced and the results of experiments on its control presented. A comparative study of the literature on plants and animal tumours leads to the rejection of the theory of a parallel between crown gall and cancer [*R.A.M.*, xvii, p. 163 *et passim*].

Magrou (J.). **Nouvelles observations sur l'immunité humorale chez les plantes.** [Further observations on humoral immunity in plants.]—*Rev. Path. vég.*, xxv, 3, pp. 181–189, 1938.

This is a condensed account of the experiments on humoral immunity from *Bacterium tumefaciens* in plants, which were described and discussed at length in a recent communication [*R.A.M.*, xvii, p. 799].

WATERHOUSE (W. L.). **Presidential address. Part I. General. Part II. Some aspects of problems in breeding for rust resistance in cereals.**—*J. roy. Soc. N.S.W.*, lxxii, pp. 1–54, 1938.

In the second part of this address the author discusses in some detail different aspects of the breeding of cereals for rust resistance. Tables are given showing varietal resistance to the different physiologic races of these fungi so far identified in Australia and New Zealand. Of the nine races of wheat stem rust (*Puccinia graminis tritici*) found on material from these two countries, three, viz., 43, 44, and 54, are similar, as are three others, viz., 45, 46, and 55; both groups differ widely from each other and from the remaining races 11, 34, and 59. Six races of oats stem rust have been found in Australia, viz., 1, 2, 3, 6, 7, and 8. A complex of 1 with or without 2 is most prevalent; a complex of 3 with or without 7 does not, as a rule, appear early in the rust season, and characteristically attacks the 'side' oats, most of which mature late. Races 6 and 8 are rare. Five races of oat leaf rust (*P. coronata avenae*) [*P. lolii*] have been identified in Australia, viz., 3, 6, 7, 40, and 47. Isolates of barley leaf rust (*P. anomala*) showed no difference in specialization, except in one case, which produced the resistant '2' reaction on Kinner barley.

THIEL (A. F.). **The overwintering of urediniospores of Puccinia graminis tritici in North Carolina.**—*J. Elisha Mitchell sci. Soc.*, liv, 2, pp. 247–255, 3 graphs, 2 maps, 1938.

The results of germination tests of uredospores of stem [black] rust of wheat (*Puccinia graminis tritici*) from 1935 to 1938 in North Carolina showed a high percentage (85 to 95) of viability during October, followed by a sharp drop in November (40 to 75 per cent.) and subsequent months to nil in February. Weather conditions favoured fresh uredospore infections during three different periods in October of each year and in the first week of November in 1935 and 1936, following which new sori were found on wheat. In November, 1937, the requisite conditions were absent and no fresh uredosori were formed. Circumstantial evidence denotes that the primary inoculum in North Carolina does not arise from overwintering uredospores in the State but originates with the northward migration of uredospores from neighbouring south-westerly States where they overwinter.

Mercurial dusts and seed germination.—*Fertil. Feed. St. J.*, xxiii, 24, pp. 627, 629, 1938.

Information regarding the progress of investigations initiated at the Official Seed Testing Station, Cambridge, on the effect of mercurial dusts on seed germination was recently supplied by C. C. Brett at a conference of seed analysts. The abnormal germination of cereal seed-grain sometimes following the use of these preparations may be due to 'over-dressing'. Seed in a healthy condition and of normal moisture content does not usually retain on its surface more than $2\frac{1}{2}$ to 3 times the recommended fungicidal dosage, and the marked phytocidal effect of mercury treatment occasionally encountered may therefore be generally attributed to an undue amount of moisture on or in the seed (chiefly the former) or unsuitable storage conditions. With proper

precautions in these respects there should be very little loss of germinative capacity even in seed-grain stored for periods up to two years.

In the course of the ensuing discussion it was mentioned that wheat appears to be slightly more susceptible to the ill effects of 'overdressing' than oats or barley. Treated mangold seed in one instance showed a higher percentage of germination after 4½ years than the controls. The application of mercurial preparations to turnips and swedes at the customary cereal doses had little injurious effect in greenhouse tests at Cambridge: one manufacturer, however, suggests the admixture with the dressing of a small quantity of whiting to secure an appropriate dilution for application to minute seeds.

MULDER (E. G.). **Over de beteekenis van koper voor de groei van planten en micro-organismen, in het bijzonder een onderzoek naar de oorzaak der ontginningsziekte.** [On the importance of copper for the growth of plants and micro-organisms, with special reference to a study of the cause of reclamation disease.]—*Landbouwk. Tijdschr., Wageningen*, l, 618, pp. 898–902, 1938.

Of the plants examined by the writer in water and quartz sand cultures, the most susceptible to reclamation disease induced by copper deficiency [*R.A.M.*, xviii, p. 163] were canary seed [*Phalaris canariensis*] and wheat, followed by barley, oats, and peas, while rye and potatoes were not appreciably affected [ibid., xvii, p. 386]. Soil analyses by Neubauer's method showed that the more defective the soil, the smaller were the quantities of copper assimilated by the plants. Estimation of copper by the *Aspergillus niger* spore method [see next abstract] showed that severely 'diseased' soils contained less than 0·4 γ [$\gamma = 0{\cdot}001$ mg.] copper per gm. dry material compared with 2·5 γ or more in 'healthy' soils and 0·8 to 1·3 γ in those of intermediate condition. There was less than 1 mg. copper per kg. dry substance in the seed of diseased plants as against considerably larger amounts (up to more than 5 mg.) in that of healthy ones.

Field observations in Holland showed that in some cases the actual copper content of the soil is not inadequate, but the element is rendered unavailable either by the nature of the soil, e.g., in marshes, or by the occurrence therein of certain copper-fixing micro-organisms, such as *Bacillus putrificus*, *B.* [*Bacterium*] *coli*, and *Vibrio desulfuricans*. The deficiency of available copper may be remedied by the application to the soil of ammonium sulphate, appropriate cultural operations and green manuring, and seed treatment with 0·3 per cent. copper sulphate.

Magnesium deficiency [formerly known as 'soil acidity'] disease of oats [ibid., xvii, p. 386] is frequently observed in fields suffering from copper shortage, where wheat is also attacked with particular severity by *Septoria nodorum* [ibid., vii, p. 766] and another unidentified fungus producing blackish-brown stripes or spots on the straw and oblong, blackish-brown lesions on the uppermost parts of the haulms. Another phenomenon connected with copper deficiency is the 'licking' disease of cattle fed on hay or grass from affected fields.

Besides *A. niger* [ibid., xvi, p. 199], *A. flavus* and *Penicillium glaucum* were also found to need small quantities of copper (irreplaceable by other elements) for their normal development. Various transformations

induced by copper in micro-organisms indicate that the mineral probably functions as an oxidation catalysator in biological processes.

MULDER (E. G.). **Sur l'influence du cuivre sur la croissance des micro-organismes.** [On the influence of copper on the growth of micro-organisms.]—*Ann. Ferment.*, N.S., iv, 9, pp. 513–533, 4 figs., 1 graph, 1938.

Further details are given of the author's method of determining the copper content of Dutch soils, in relation to the probability or otherwise of the development of reclamation disease in white oats, barley, and wheat, by the growth of *Aspergillus niger* in a synthetic culture solution devoid of copper and supplemented by 1 gm. per 40 cc. of the soil samples to be tested [see preceding abstract]. A black coloration of the spores denotes a healthy soil ($2\frac{1}{2}$ γ assimilable copper per gm. of dry soil), while a yellow, brownish-yellow, or brown tint, corresponding to 0·2, 0·4, and 1 γ, respectively, indicates a greater or less deficiency of the necessary element. These results were confirmed by a series of tests on wheat and oats by Neubauer's method (*Handb. PflErnähr. DüngLehre*, i, p. 882, 1931), involving the culture of the plants in glass cylinders and the estimation of the copper content of the ash. It was found that the addition to sandy soils of copper sulphate at doses corresponding to a rate of 50 kg. per hect. sufficed to release adequate quantities of copper in an assimilable form to maintain the plants in normal health. Peat soils, however, in which practically the entire original and added copper contents are fixed by certain micro-organisms [see preceding abstract], will need larger quantities and frequent applications to produce a comparable improvement.

VISSER (W. C.). **Opmerkingen betreffende een geval van halmdooder-voetziekte bij Tarwe op een stikstofhoeveelheden-proefveld op zandgrond.** [Observations on a case of straw-breaker foot rot of Wheat on a nitrogen dosage test plot on sandy soil.]—*Tijdschr. PlZiekt.*, xliv, 6, pp. 280–288, 1938.

By means of an analytical method based on pore volume determinations (*Soil Sci.*, xliv, pp. 467–479, 1937) the writer drew the following conclusions as to the correlation between soil structure and the incidence of foot rot (*Ophiobolus graminis*) [*R.A.M.*, xviii, pp. 98, 171] in Juliana wheat on a nitrogen dosage trial plot on sandy soil at Groningen, Holland, in 1937. Contrary to the accepted theory, there was a lower incidence of infection on the plots receiving liberal supplies of nitrogen (60 to 120 kg. per hect.) than on those receiving smaller quantities, the former treatment evidently tending to maintain the soil structure in a relatively compact condition, judged by the comparative numbers of narrow, medium-sized, and large pores, while the latter promoted its disintegration. Another factor contributing to the good health of the plants in the heavy nitrogen plots was their luxuriant growth, affording adequate protection against sun and rain.

Summing up the influence of the various environmental conditions on foot rot, severe attacks in the later stages of growth may be anticipated whenever the soil-water-air relationship deviates in an unfavourable direction from the ratio 50:20:30.

Niemeyer. **Prüfung einer Heisswasseranlage.** [The testing of a hot-water steeping apparatus.]—*Tech. in d. Landw.*, xix, 12, pp. 88–89, 1938.

Particulars are given of the construction and application of a new two-vat, electrically heated apparatus for the continuous hot-water treatment of barley seed-grain against loose smut [*Ustilago nuda*: *R.A.M.*, xvii, p. 594 *et passim*]. In trials at the Biological Institute, Dahlem, Berlin, the outfit (supplied by J. Reuters, Marientaler Str. 84[I], Hamburg 23) gave generally satisfactory results when the seed-grain was enclosed in muslin bags and immersed for two hours in 0·1 per cent. ceresan at an average temperature of 47·4° or 47·6° C., the percentage of emergence in the field ranging from 83·3 to 92·6 compared with a maximum of 98·2 in the untreated controls. With reasonable precautions and certain constructional improvements the apparatus may be recommended as effective for the purpose in view.

Rosen (H. R.) & Weetman (L. M.). **The 1938 crown rust epidemic of Oats in Arkansas in relation to hybrids of Bond and Victoria.**—*Phytopathology*, xxviii, 12, pp. 898–901, 1 fig., 1938.

An apparently new race of crown rust of oats (*Puccinia coronata avenae*) [*P. lolii*: see next abstract], to be designated 45 and attacking Bond and its hybrids, was reported by M. B. Moore and collaborators from Minnesota and Texas in 1937, when an apparently identical race was also discovered by the present writers in Arkansas, which caused a type 4 reaction in inoculation tests on all the differential varieties used (including Bond), except Glabrota, which yielded an I[mmune] response, and Victoria, the latter proving slightly more susceptible than to most collections of race 1. The new race was subsequently isolated in duplicate from 25 out of 153 collections. In greenhouse inoculation tests race 45 was far more aggressive than race 1; the Bond hybrids rapidly developed abundant and severe infection by the new race, but notwithstanding these discouraging results they displayed a very fair degree of resistance in the field. All Victoria hybrids suffered severely from crown rust under field conditions. The potential importance of the new race in relation to the rust resistance breeding programme is briefly discussed.

Stanton (T. R.), Murphy (H. C.), Coffman (F. A.), Burnett (L. C.), & Humphrey (H. B.). **New disease-resistant early Oats from a Victoria-Richland cross.**—*J. Amer. Soc. Agron.*, xxx, 12, pp. 998–1009, 1938.

Very promising results, both as regards productivity and resistance to stem [black] and crown rust [*Puccinia graminis* and *P. lolii*: see preceding abstract] and loose and covered smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*]) [*R.A.M.*, xviii, p. 99 and next abstract], have been obtained in Iowa in crosses between the highly resistant Uruguayan variety Victoria and the early maturing commercial Richland (resistant to black rust only). One or more of the selections will probably be available for distribution to Corn Belt farmers within the next few years.

Taylor (J. W.) & Coffman (F. A.). **Effects of vernalization on certain varieties of Oats.**—*J. Amer. Soc. Agron.*, xxx, 12, pp. 1010–1019, 1 fig., 1 map, 1938.

The incidence of loose and covered smuts of oats (*Ustilago avenae* and *U. levis*. [*U. kolleri*]) [see preceding abstract] was much reduced at the Arlington Experiment Farm, Virginia, from 1933 to 1937, by the process of vernalization [cf. *R.A.M.*, xv, p. 785], involving 18 to 24 hours' soaking of the seed-grain in cotton bags in tap water at a temperature of 60° to 65° F. and 28 to 45 days' storage at 32° to 34°. In the three years in which smut occurred, there was only one diseased panicle in the vernalized rows of Iogold compared with an average of 4·6 per cent. per row for the untreated, the corresponding figures for winter Lee, Fulghum (C.I. 708), winter Fulghum, and Frazier being 1·3 and 8·4, 0·4 and 9·5, 0·4 and 4·1, and 0·2 and 7·7, respectively, the total averages for the vernalized and control rows of all varieties amounting to 0·5 and 6·3 per cent., respectively.

Brandwein (P. F.). **The emergence of smut-inoculated Oat seedlings through sand and loam soil.**—*Bull. Torrey bot. Cl.*, lxv, 7, pp. 477–483, 1 fig., 1938.

Continuing his studies on the oat smuts [*R.A.M.*, xvii, p. 234], the author gives a brief account of experiments, the results of which showed that when seeds of Monarch and Markton oats, inoculated with a strain of *Ustilago levis* [*U. kolleri*] to which the first is very susceptible and the second highly resistant, were sown in a loam soil or in sand subjected to light tamping, their percentage emergence differed only slightly, if at all, from that of the uninoculated controls. When, however, the seeds of both varieties were sown in the field, the emergence of Markton was reduced by 6·7 per cent. and that of Monarch by 10·7 per cent. in the inoculated as against the uninoculated seeds. Following this result, a further experiment was made, in which single seeds of either variety were each sown in a vial with sand subjected to slight or severe tamping, with the result that in the latter series the emergence of Monarch was reduced from 95 to 75 and that of Markton from 100 to 85 per cent., while in the first series the emergence was 100 per cent. throughout. Examination of the seedlings in tightly packed sand showed a smaller size and lower germination of the inoculated plants as compared with the uninoculated controls. It is suggested that the failure of the plants to penetrate heavily tamped soil may be due to the coleoptile infection [loc. cit. and ibid., x, p. 722; xvii, p. 235] in the inoculated resistant and susceptible oat varieties.

Pathology and mycology of Corn.—*Rep. Ia agric. Exp. Sta., 1937–38*, Part ii, pp. 51–59, 1938.

In studies by I. E. Melhus and G. N. Davis, infection of maize by *Ustilago zeae* [*R.A.M.*, xvii, p. 670] did not take place at wounded surfaces, but at the growing points of the plants, demonstrating that meristematic tissue is necessary for infection.

I. E. Melhus, in further investigations on the *Diplodia zeae* inhibitor [loc. cit.], found that slight growth occurred when the filtrate from an old culture of *D. zeae* on Czapek's medium containing dextrose was

concentrated to one-third, one-fifth, or one-tenth of its normal volume, and 20 c.c. tested against the fungus in the usual way. These concentrated solutions, unlike the normal filtrates, inhibited the organism as strongly at 26° as at 16° C. The inhibition was not destroyed by boiling with trichloracetic acid for one hour. A water extract from maize meal from ears heavily infected with *D. zeae* induced strong inhibition. The inhibitor was not formed in 50 days in cultures in 2 per cent. dextrose solution or on media in which an ammonium salt, asparagin, or leucine was used as the source of nitrogen.

C. S. Reddy states that infection of serial plantings of maize by *Basisporium gallarum* [*Nigrospora* spp.: loc. cit.] was heaviest in the very late plantings. In general, the amount of infection was correlated with cob reaction, but not with water-soluble material in the cobs.

G. N. Davis, C. S. Reddy, I. E. Melhus, W. E. Loomis, E. W. Lindstrom, and A. A. Bryan, in their studies on disease resistance in maize, describe a method of testing resistance to *D. zeae* by raising seedlings in autoclaved, inoculated soil in glass lamp chimneys, incubated at 20°. Readings were taken three weeks after planting. In another test the outer covering of mature stalks was removed and the pith dried and ground. A significant difference was found in the size of the colonies grown on stalk meal from different inbred lines. The stalk meal of Os 426 supported the least fungus growth (average size of colony, 9·62 sq. cm.) and L 289 the most (39·8 sq. cm.). When ground stalk tissue from each line was extracted with hot distilled water, the extract reduced in volume, agar added, and plates poured and inoculated, the extract from Os 426 again supported the least, and that from L 289 the most, fungal growth. The properties of the mature stalk upon which growth and perhaps resistance or susceptibility to *D. zeae* stalk rot depend are, apparently, removable by hot water. Analysis of extracts from eight lines indicated a possible correlation between fungal growth on the ground stalk meal and the sucrose reserve in the stalk.

In studies by E. W. Lindstrom (reported on pp. 46–47) into the change of virulence in *Bacterium* [*Aplanobacter*] *stewarti* [ibid., xvii, p. 388] by repeated passage through susceptible and resistant inbred maize lines, the rate of change was most rapid in the first passages. Virulent strains of *A. stewarti* produce large, smooth, spreading, mucoid colonies, whereas avirulent strains form smaller, rather rough, raised, non-mucoid colonies. When a suspension of a known ratio of virulent to avirulent bacteria (determined by colony type) was inoculated into resistant and susceptible lines, selection in the host was for the avirulent type within the susceptible lines, and for the virulent type within the resistant line. The data obtained indicated that the rate of change per passage was higher in the susceptible than in the resistant line. Investigation of the extent to which the resistance of an inbred line can be changed by altering certain nutrient elements and environmental conditions showed that, with the treatments used, resistance decreased with the increase in nitrogen, ammonium producing more effect than nitrate. High concentrations of phosphorus decreased resistance, while high concentrations of calcium and potassium increased it. Low moisture, as compared with high moisture, and high, as compared with low light, increased resistance. Of

the treatments tested, nitrogen and water supply had the most pronounced effect.

STOREY (H. H.). **Investigations of the mechanism of the transmission of plant viruses by insect vectors. II. The part played by puncture in transmission.**—*Proc. roy. Soc.*, Ser. B, cxxv, 841, pp. 455-477, 2 pl., 1938.

This is a full account of the author's experiments in the investigation of the mechanism of transmission of maize streak virus by *Cicadulina mbila*, an abstract from which has already been noticed [*R.A.M.*, xvii, p. 386].

BÖNING (K.). **Helminthosporiosen an Mais.** [Helminthosporioses of Maize.]—*Prakt. Bl. Pflanzenb.*, xvi, 7–8, pp. 159–167, 5 figs., 1938.

The diseases of maize caused by species of *Helminthosporium* are stated to have attracted little attention so far in Germany. In the past year, however, a severe outbreak of brown spotting occurred in two localities in southern Bavaria on various maize varieties, causing premature death of the leaves. The fungus was identified as *Helminthosporium maydis* (the conidial stage of *Ophiobolus heterostrophus*), although it differed slightly from the descriptions by Drechsler [*R.A.M.*, v, p. 293] and Nisikado and Miyake [ibid., v, p. 734] in the colour of the spots (brown, sometimes with a bluish-violet margin), their size (3 by 2 to 80 by 30 mm.), in the less marked curvature of the conidia, and in cultural characters (poor development of conidia, which are shorter than usual). The careful removal of all straw is recommended, together with a well-regulated crop rotation. Seed disinfection is also advised, although there is no proof as yet that the disease is seed-borne.

CARRANTE (V.). **Il mal secco dei Limoni e i mezzi di lotta più consigliabili allo stato attuale delle conoscenze.** ['Mal secco' disease of Lemons and the methods of control recommended in the present state of knowledge.]—*Boll. Staz. Agrum. Frutt. Acireale*, 70, 32 pp., 28 figs., 1938.

The author gives a clear and succinct account in popular terms of the symptoms, method of spread, and control of 'mal secco' disease of lemons (*Deuterophoma tracheiphila*) [*R.A.M.*, xvii, p. 727]. The recommendations made on the last-named subject include the removal and destruction of affected branches, measures to tone up the general health of the trees, spraying, pruning, clipping instead of pulling off the fruit, the provision of wind-breaks, attention to soil factors, top-grafting on sweet orange [ibid., xii, p. 565] with bitter orange as the root stock, and a continued search for desirable resistant varieties. The susceptible 'Femminello comune' lemon variety is preferred by many growers to the resistant Monachello, as it comes into bearing much sooner after grafting (three years, as against seven for Monachello) and gives double the yield of much better quality fruit.

The advantages of top-grafting even the resistant Monachello lemon on sweet orange are that this practice reduces the incompatibility between bitter orange and Monachello, and that the resultant plant is rendered

immune from or highly resistant to the disease by the antibodies produced by the metabolism of the sweet orange. It has been proved that the sweet orange possesses thermostable and thermolabile substances which, in laboratory cultures, retard the development of the fungus, and it is considered that these may pass to the lemon.

La moisissure bleue et la moisissure verte des fruits d'Aurantiacées. (Penicillium italicum Wehm. et P. digitatum Sacc.). [The blue mould and green mould of Citrus fruits. (*Penicillium italicum* Wehm. and *P. digitatum* Sacc.).]—*Memento, Déf. Vég., Rabat*, 55, 12 pp., 2 pl., 1938.

A concise account is given in popular terms of the blue and green moulds (*Penicillium italicum* and *P. digitatum*, respectively) [*R.A.M.*, xvii, p. 741; xviii, p. 102] of citrus fruits in Morocco, together with full, practical recommendations for their control by the prevention of rind injury, improved methods of packing, chemical treatments, and cold storage.

Hwang (L.) & Klotz (L. J.). **The toxic effect of certain chemical solutions on spores of Penicillium italicum and P. digitatum.**—*Hilgardia*, xii, 1, pp. 1–35, 3 figs., 2 diags., 4 graphs, 1938.

With the object of securing an effective means of controlling the blue and the green moulds of citrus (*Penicillium italicum* and *P. digitatum*) [see preceding abstract], the authors conducted germination and dilution plate tests in which the spores of the two fungi were immersed in a number of chemical solutions of various concentrations and their subsequent viability compared with that of untreated spores. The spore suspensions were made up in 0·25 per cent. solutions of a non-toxic soap found to wet and disperse the spores effectively without impairing the germination, shaken for ten minutes, and then 5 c.c. of each of the suspensions transferred to sterile centrifuge tubes. These tubes were centrifuged for three minutes in order to precipitate the spores, the supernatant solution was then decanted, 10 c.c. of the chemical solution added, and the tube shaken thoroughly. About three minutes before the treatment time had elapsed the tubes were centrifuged, and at the end of the three minutes the chemical solution was decanted and the spores washed with distilled water. The germination tests were carried out in Van Tieghem cells, in fresh sweet orange juice, and at an incubation temperature of 77° F. In the dilution tests dilutions were transferred to Petri dishes, glucose potato agar added, and the colonies counted after two or three days' incubation at 77°.

Distilled water at 120° for five minutes killed about 90 per cent. of the spores. The results of tests in which the spores of the two fungi were exposed to 6 per cent. borax at 110° for 2, 4, 6, 8, 10, 12, 14, and 16 minutes, and at room temperature (66° to 72°), 80°, 100°, 110°, and 120° for five minutes, and to borax concentrations of 4, 6, 8, 10, and 12 per cent. for five minutes at 110°, showed that the longer the exposure, the higher the temperature and the stronger the concentration of the chemical, the more effective was the solution in reducing both the germination and the growth in plates. Similar

results were obtained with sodium carbonate and the new material, metbor, the latter, however, not being so toxic to the spores as borax. The toxicity of the various solutions to the spores of the two fungi appeared to depend more on temperature than on the concentration of the chemicals or the period of immersion. A five minutes' exposure at 120° to 6 per cent. borax-boric acid mixture, 6 per cent. metbor, 0·4 per cent. chloramine-T, or 6 per cent. sodium carbonate, was lethal to the spores of both fungi. In tests with dinitro-o-cyclohexylphenol, a substance shown by L. J. Klotz and L. L. Huillier in unpublished work to be effective in decreasing the number of brown rot (*Phytophthora citrophthora*) infections on lemon from 51·45 to 1·45 per fruit, exposure for two to five minutes to a saturated solution resulted in only a slight inhibitory effect on germination. A five minutes' exposure to 6 per cent. sodium bicarbonate at 86°, 100°, 110°, and 120° showed no advantage of the chemical over water. At 86°, exposure to a 10 per cent. solution of sodium bicarbonate for five minutes or to one of 6 per cent. for ten minutes, had little effect on the spores of either fungus. Exposures of two minutes to 0·4, 0·6, and 1·0 per cent. sodium hypochlorite killed the spores of both fungi. Apart from the last-named, the three most effective solutions, when used at 100° or below for five minutes, were 6 per cent. sodium carbonate, 0·15 per cent. sodium o-phenylphenate, and 6 per cent. borax; at 100° and 120° the most toxic were 0·4 per cent. chloramine-T, 6·0 per cent. sodium carbonate, and the 6 per cent. mixture (2:1) of borax-boric acid.

Perlberger (J.) & Reichert (I.). **Experiments on the control of albinism in Citrus seedlings.**—*Palest. J. Bot.*, R Ser., ii, 1, pp. 40–78, 3 pl., 1938.

A fully tabulated account is given of the writers' studies on albinism in citrus seed-beds in Palestine [*R.A.M.*, xvi, p. 451], where the incidence of the condition ranges from 0 to 74 per cent. Some of the sweet lime [*Citrus limetta*], sour orange, grapefruit, and rough lemon seedlings examined were yellowish-white, while others were yellowish or partly white and partly green. In some cases the stem was white and the leaves green, in others the stem green and the foliage yellowish, whitish, or parti-coloured. In certain instances only the veins were green and the rest of the leaf yellowish-white, while occasionally the reverse condition was observed. Generally the first two leaves of the albino seedlings were white, while the third and fourth (the latter seldom developing) might be either white or very rarely green. Exposed to direct sunlight, albino plants degenerate in a few days, but in the shade or in a closed room they may be kept alive for five to eight weeks.

Extensive field and laboratory experiments showed that complete or almost complete control of the disorder is obtainable by 20 minutes' immersion of the seeds in uspulun, ceresan, or germisan, e.g., at $\frac{1}{8}$ or $\frac{1}{4}$ per cent., and by dusting with abavit. Soil treatments with the same preparations, however, did not give satisfactory results. In laboratory trials, dipping the seeds in solutions of cobalt nitrate (1/400 N), copper chloride (1/200 N), mercuric chloride (1/800 N), and nickel chloride (1/200 N) gave effective control.

The condition is regarded as an inherent constitutional defect, the

appearance of which at the time of seed germination may coincide with a disturbance of the enzymic system at this stage.

Fawcett (H. S.). **Development of psorosis (scaly bark) in relation to origin and history of various Citrus varieties.**—*Calif. Citrogr.*, xxiv, 1, pp. 6, 30–32, 4 figs., 1938.

In summing up the available experimental and observational evidence on psorosis of citrus [*R.A.M.*, xviii, p. 248] the author states that the virus which is believed to cause this disease is usually systemic, so that all buds will transmit the infection. The different symptoms produced on the bark, known as psorosis A, psorosis B, concave gum disease, and possibly corky bark, are attributed to different virus strains which have varying degrees of virulence, just as different varieties of citrus seem to have varying degrees of susceptibility to the disease. The evidence collected by the author indicates that none of the original varieties, such as Navel and Valencia oranges or Eureka and Lisbon lemons, had the virus in it when first brought to California, but that it was present in some of the varieties subsequently top-worked to the original ones, and that the buds from these scions spread the disease when used for propagation. It appears, therefore, that psorosis could be avoided in future, if only buds from disease-free trees were taken for propagation, a measure facilitated by the registration of trees free from psorosis instituted as a voluntary service by the California Department of Agriculture. It is believed that by making use of this service the disease could be so greatly reduced in a generation that a subsequent campaign of eradication would entirely rid California of psorosis.

Fawcett (G. L.). **La 'psorosis' en los Naranjos de Tucumán.** ['Psorosis' in Tucumán Oranges.]—*Rev. industr. agric. Tucumán*, xxviii, 4–6, pp. 101–103, 2 figs., 1938.

A popular note is given on the symptoms and mode of transmission of citrus psorosis [see preceding abstract] in connexion with the recent detection of the disease in oranges in Tucumán, Argentine Republic, by H. S. Fawcett and A. A. Bitancourt.

Brixhe (A.). **Les parasites du Cotonnier au Congo belge.** [Cotton parasites in the Belgian Congo.]—*Bull. Com. coton. congol.*, iii, 11, pp. 72–95, 26 figs., 1938.

This is a useful key for the determination of the insect pests and diseases of cotton in the Belgian Congo, the latter including anthracnose [*Glomerella gossypii*: *R.A.M.*, xv, p. 719], collar canker [? *Neocosmospora vasinfecta*: ibid., ix, p. 33], wilt (verticilliosis or fusariosis) [? *Verticillium albo-atrum* or *Fusarium vasinfectum*: ibid., ix, p. 240; xiv, p. 224; xv, p. 719], damping-off (*Rhizoctonia*) [*Macrophomina phaseoli* and *Corticium solani*: ibid., ix, p. 32; xv, p. 578], capsule rot (*Diplodia*) [*gossypina*: ibid., xv, p. 719], mosaic [cf. ibid., xi, p. 239], internal bacterial rot, red rot [ibid., xv, p. 719], rust (*Alternaria*), stem blight (*Sclerotium*) [? *rolfsii*: ibid., xiv, p. 223; xvi, p. 95], and stigmatomycosis [*Nematospora coryli* and *N. gossypii*: ibid., xv, p. 719].

Okabe (N.). **Bacteriophage in relation to Bacterium malvacearum. II. Relation between variants and phage.**—*Ann. phytopath. Soc. Japan*, viii, 3, pp. 230–246, 1 pl., 1 fig., 1938. [Japanese, with English summary.]

All the nine variants derived from strain 427 of *Bacterium malvacearum*, isolated from angular leaf spots of cotton at Taihoku, Japan, were resistant to the bacteriophage extracted from the diseased foliar tissues by Matsumoto and Huzioka [*R.A.M.*, xvii, p. 521], while some of the 23 proceeding from strain 450 showed varying degrees of susceptibility, generally correlated with the dimensions of the plaques formed in the cultures. An increase in the incubation period coincided with plaque expansion in cultures of variants E, J, and M. The bacteriophage under investigation was found to consist of at least two primary elements, one active against all the variants and the other failing to induce lysis in E, J, M, O, and P. The size and number of plaques decreased more or less parallel with the amount of bacterial inoculum used (from 140 with an average diameter of 8·5 mm. after five days with one drop to 98 (4·2 mm.) with 32 drops). A fall in temperature led to an increase in the number and size of the bacteriophage plaques (1,368 with a diameter of 0·5 to 0·8 mm. after 48 hours at 28° as compared with 137, 0·2 to 0·5 mm., at 34° C. in the case of A^1), the corresponding figures after six days for J^1 at 25° and 34° being 150 (8·5 mm.) and 6 (0·3 mm.), respectively. There were no apparent morphological differences between the bacteriophage-resistant variants developed in culture and their susceptible progenitors.

Luthra (J. C.) & Vasudeva (R. S.). **Studies on the root-rot disease of Cotton in the Punjab. V. Confirmation of the identity of Rhizoctonia bataticola.**—*Indian J. agric. Sci.*, viii, 5, pp. 727–734, 1 fig., 2 graphs, 1938.

Further studies have been undertaken to determine the exact systematic position of *Rhizoctonia bataticola*, strain 22 (*a*), which is jointly responsible with *R.* [*Corticium*] *solani* for root rot of cotton in the Punjab [*R.A.M.*, xvii, p. 33], in comparison with *R. bataticola*, isolated by Hopkins from banana roots [ibid., xiii, p. 494] in Rhodesia (strain 3113*c*), the same from lemon roots [ibid., xii, p. 727] (998), and *R. lamellifera* [ibid., xvi, p. 787] from lucerne roots. The cotton root rot strain closely resembled that from banana, and to a lesser extent the lemon isolation, on Vasudeva's synthetic medium, Richards's agar, and potato extract, the optimum growth of all three being made at 30° C., at which *R. lamellifera* develops very poorly. Strain 22 (*a*) further differs from the last-named in the production of white, later dark grey, colonies. The cotton strain tends to throw out saltants, the persistence of which requires further testing, on shallow-poured plates of Richards's agar. Strain 22 (*a*) also closely approximates to 3113*c* in its reactions to acidity or alkalinity of the medium, both growing best at P_H 4·8. Another similarity between the cotton and banana strains lies in their sclerotial dimensions (average 105·45±2·23 and 104·25± 2·33 μ, respectively, compared with an average of 9·90 [? 990] ±1·79 μ for *R. lamellifera*).

In soil inoculation tests on 43 F cotton (*Gossypium hirsutum*) plants, one series (20 days old) was maintained at a constant temperature of 30°, while two others (35- and 51-day-old plants) were kept in a greenhouse with fluctuations of temperature. The following mortality percentages were obtained in the three series: strain 22 (*a*), 83·33, 79·09, and 70·58, respectively; strain 3113*c*, 0, 0, and 0; strain 998, 15, 14·06, and 4; and *R. lamellifera*, 0, 0, and 0. The cotton and banana strains are thus quite distinct as regards pathogenicity, though closely similar in cultural characters. The former should therefore be regarded as a strain of *R. bataticola* [*Macrophomina phaseoli*].

Кокин (A. J.). К физиологии больного увяданием Хлопчатника. [On the physiology of the wilted Cotton plant.]—*ex* Symposium dedicated to the memory of V. N. Lubimenko, pp. 329–347, 2 figs., Ukr. S.S.R. Acad. Sci. Press, Kieff, 1938. [English summary.]

The experiments described in this paper were carried out under hothouse conditions in Leningrad during the summer of 1935 to investigate the mechanism and physiology of wilting in the cotton plant. Potted plants of *Gossypium herbaceum* No. 7450 (from west China) were inoculated with pure cultures of *Fusarium bukaricum* [*R.A.M.*, xvii, p. 109] through incisions at the base of the stems, and potted plants of the American Upland No. 1306 cotton were inoculated by mixing microsclerotia of *Verticillium dahliae* [ibid., xvii, p. 814] in the soil in which they were grown. The plants in the first series wilted suddenly 18 to 21 days after inoculation, after which they rapidly died; in the second series the Upland cotton plants did not wilt, apart from a few exceptions, presumably owing to unfavourable weather conditions (predominantly overcast), but the typical discoloration of the internal tissues of the stems evidenced the successful establishment of the fungus in the plants. Sharp disturbances were observed in the water balance of the wilting *G. herbaceum* plants, as indicated by a considerable decrease in the intensity of transpiration (66·8 per cent. of that in the controls), and by the fact that in the diseased plants the water content of the leaves in the afternoon was 35 per cent. of that calculated in the morning, while in healthy plants it dropped to 25 per cent. of the morning content. As wilting occurred in soil containing 50 to 60 per cent. of its maximum moisture-holding capacity, it is considered to have been due to other causes than lack of soil moisture. The determination at two different dates of the total soluble carbohydrates in the leaves of infected *G. herbaceum* plants before wilting, at the onset of wilting, and in severely wilted plants gave 10·09, 10·45, and 11·02, and 12, 12·38, and 20 per cent. of the dry weight, respectively, as against 6·21 and 10·47 per cent., respectively, in the healthy plants. The protein content of the leaves, on the other hand, was found on the same dates to have been lowered to 20·62, 20·62, and 20·21, and 19·93, 19·81, and 18·31 per cent. of the dry weight, respectively, from 21·06 and 20·6 per cent., respectively, in the controls. The fact that the osmotic pressure of the cell sap in diseased *G. herbaceum* leaves was higher than in healthy plants is attributed to the accumulation in the former of soluble carbohydrates and to hydrolysis of their proteins. When excised portions of healthy *G. herbaceum* leaves were kept in an extract of a diseased

stem, the cells were killed in 18 to 20 hours, but remained alive when they were kept in extracts of healthy stems, demonstrating the secretion of toxic substances by *F. buharicum*.

The results of the studies on Upland cotton are stated to have shown that in leaves exhibiting distinct symptoms of the disease the activity of catalase is somewhat decreased as compared with that in the healthy plant, while the activity of peroxidase is considerably increased, in some cases up to almost twice that in healthy plants. The osmotic pressure of the cell sap in the leaves of infected plants was found to be higher than in healthy; this is explained by an insufficient water supply to the leaves due to a partial stoppage of the vessels by the hyphae of the fungus.

Comandon (J.) & De Fonbrune (P.). **Recherches expérimentales sur les champignons prédateurs de Nématodes du sol. Conditions de formation des organes de capture. Les pièges garrotteurs. Les gluaux ou pièges collants.** [Experimental studies on fungi preying on soil Nematodes. Conditions of formation of organs of capture. Strangling traps. Snares or adhesive traps.]—*C.R. Soc. Biol., Paris*, cxxix, 30, pp. 619–625, 1938.

Dactylaria brochopaga [originally described as *Dactylella brochopaga* but figured as *Dactylaria brochopaga*: *R.A.M.*, xvii, p. 36], *Dactylella bembicodes*, *D. ellipsospora*, *Arthrobotrys oligospora*, and *Stylopage hadra* [loc. cit. and cf. ibid., xvii, p. 597] were isolated from the soil in the garden of the Institut Pasteur annex at Garches [near Paris], and induced to form their typical organs of capture [see above, p. 232] (strangling loops in the two first-named, pads of adhesive substance in the other three) by the addition to a beer wort and Quaker oats agar medium of nematode eggs, sterilized in 10 per cent. eau de Javelle or of water previously occupied by the living eel-worms in a sterile condition. The modes of formation of the different organs of capture and their application are very fully described.

Goodey (T.). **Observations on the destruction of the stem Eelworm, Anguillulina dipsaci, by the fungus Arthrobotrys oligospora Fres.**—*J. Helminth.*, xvi, 3, pp. 159–164, 4 pl., 1938.

In March, 1938, the leaves of Little Gem yellow calceolarias (*Calceolaria integrifolia*) submitted for examination from the South-Eastern Agricultural College, Wye, Kent, showed a brownish-black discoloration and swelling of the tissues near the main vein on the under side of the petiole, due to heavy parasitization by *Anguillulina dipsaci*, large numbers of which were found to be entangled in the hyphal rings or loops of a fungus forming in a moist atmosphere piriform, uniseptate conidia, 22 to 25 by 10 to 12 μ, agreeing with Drechsler's description of *Arthrobotrys oligospora* [see preceding abstract]. The same fungus is believed to have been implicated in the destruction of *Anguillulina dipsaci* in the rotted crowns and blackened leaves of *Saxifraga cotyledon* from the Royal Horticultural Society's Garden, Wisley, Surrey, examined in 1928. Presumably the fungus enters the plant either by the spread of the hyphae into the tissues from the soil, or by means of conidia splashed on to it in the course of watering.

Charles (Vera K.). **A new entomogenous fungus on the Corn earworm, Heliothis obsoleta.**—*Phytopathology*, xxviii, 12, pp. 893–897, 3 figs., 1938.

English and Latin diagnoses are given of *Spicaria heliothis* n.sp., found parasitizing pupae of the maize earworm (*Heliothis obsoleta*) in hibernation cages at the Arlington (Virginia) Experimental Farm in 1936, 1937, and 1938. The bodies of the insects contained a densely packed mass of white, septate mycelium, completely occluding all the organs except the alimentary canal, and accompanied in the younger material by blastocysts similar to those described by Speare for *Sorosporella uvella* (*J. agric. Res.*, xviii, pp. 399–440, 1920). Occasionally a cobweb-like growth was exuded through the sutures and spread over the surface of the body.

The fungus grew readily on various standard media, forming white, sometimes zonate colonies and slender synnemata on Molisch, potato, and maize meal agar, while on wort the synnemata were broadly flabelliform and flattened. *S. heliothis* is characterized by solitary or gregarious synnemata, 1 to 1·5 cm. in height, simple or branched conidiophores bearing 3 to 8 whorls of 3- to 5-verticillate or irregularly grouped, oblong pro-phialides, 7 to 8 μ; globose phialides with short sterigmata; and variable, ovate to elliptical conidia, in long chains, 5 to 7 by 3 to 3·5 μ.

Kambayashi (T.). **Über eine neue Varietät von Scopulariopsis blochi als Erreger einer Dermatomykose.** [On a new variety of *Scopulariopsis blochi* as the agent of a dermatomycosis.]—*Bot. Mag., Tokyo*, lii, 624, pp. 635–641, 3 figs., 1938.

Full details are given of the cultural and morphological characters of a species of *Scopulariopsis* recently isolated from a toe-nail infection in a 67-year-old man in Japan, where the occurrence of representatives of this genus as human pathogens is stated to be exceedingly rare. The fungus under observation differs from the related *S. minimum* [*R.A.M.*, ix, p. 720] in its larger conidia (3·2 by 2·5 μ), absence of phialids, and colour of the colonies, and is considered to approximate most nearly to *S. blochi* (spore dimensions 3 to 4 by 1·5 to 2 μ), from which it must be distinguished, however, by its failure to form perithecia. The newly detected agent of onychomycosis is accordingly recorded as a new variety of *S. blochi*, but is not named.

Mosto (D.). **Die blastomykotischen Granulome.** [The blastomycotic granulomata.]—*An. Fac. Med. Montevideo*, xxiii, pp. 585–596, 1938. [Spanish. Abs. in *Zbl. Haut- u. GeschlKr.*, lxi, 1–2, p. 33, 1938.]

A description, accompanied by a number of histological illustrations, is given of the changes induced by *Paracoccidioides brasiliensis* [*R.A.M.*, xvii, p. 598] in various human organs.

Baker (R. D.). **Comparison of infection of Mice by mycelial and yeast forms of Blastomyces dermatitidis.**—*J. infect. Dis.*, lxiii, 3, pp. 324–329, 5 figs., 1938.

In experiments at the Duke University School of Medicine, North

Carolina, the mycelial form of a strain of *Blastomyces* [*Endomyces*] *dermatitidis* [*R.A.M.*, xviii, p. 179] grown on Sabouraud's medium at room temperature was found to be as effective as the yeast phase, isolated from a 37-year-old negro and cultured on blood agar at 37° C., in causing the death of mice and extensive abdominal and pulmonary lesions, when weighed equivalent dosages were injected intraperitoneally.

Venturi (T.). **Contributo alla così detta blastomicosi cutanea. Un caso di dermatoendomicosi da Endomyces albicans Vuillemin con grave setticemia.** [A contribution to the knowledge of the so-called cutaneous blastomycosis. A case of dermatoendomycosis due to *Endomyces albicans* Vuillemin, with acute septicaemia.]—*Dermosifilografo*, xiii, pp. 450–466, 1938. [Abs. in *Zbl. Haut- u. GeschlKr.*, lxi, 5, p. 263, 1939.]

A description is given of a case of dermatoendomycosis with acute septicaemia caused by *Endomyces albicans* [*R.A.M.*, xiv, p. 582].

Langeron (M.) & Guerra (P.). **Nouvelles recherches de zymologie médicale.** [New researches in medical zymology.]—*Ann. Parasit. hum. comp.*, xvi, 1, pp. 36–84; 2, pp. 162–179; 5, pp. 429–473; 6, pp. 481–525, 22 pl., 3 figs., 1938.

In this paper, a preliminary note on which has already appeared [*R.A.M.*, xvi, p. 480], an exhaustive account is given of further researches on the yeast-like fungi previously studied by the senior author [ibid., xi, p. 476], the methods used being described in detail. Following a historical survey of the work done on the systematic position of the yeast-like fungi, and a discussion of the present state of the problem, the authors describe in detail the 16 species of anascosporous, yeast-like fungi which they consider to be at present alone valid in medical zymology. All are placed in the genus *Candida* Berkhout 1923, in which they are arranged in seven groups. The following diagnosis [in French] is given of the genus, as now emended: yeast-like, anascosporous fungi (Torulopsidaceae-Mycotoruloideae sensu Lodder 1934) regularly parasitic on man and mammals, capable of developing a filamentous apparatus on suitable media. This, consisting solely of catenulate blastospores (sensu Vuillemin 1910) is a pseudomycelium (sensu Langeron and Talice 1932) [ibid., xi, p. 476] represented by verticils of blastospores which develop at the apex of each joint and are arranged at regular intervals. The pseudomycelium and the sporulating apparatus separate the Mycotoruloideae from the Torulopsoideae (Lodder), but are sometimes also found in the ascosporous yeasts. They are an imperfect form of reproductive mechanism, analogous to the conidial states of the other Ascomycetes. Fermentative ability is absent, or more or less developed; in the latter case characteristic for certain sugars or groups of sugars. The 16 species considered valid are divided into groups as follows: (1) *C. albicans* group (including *C. albicans* and *C. triadis*), fermenting glucose and maltose, and having chlamydospores; (2) *C. tropicalis* group (including *C. tropicalis*, *C. intermedia*, and *C. pelliculosa*), fermenting glucose, maltose, saccharose, showing a ring and a mucous veil, and not assimilating urea; (3) *C.*

pseudotropicalis group (including only this species), fermenting glucose, saccharose, lactose, raffinose, not maltose, and assimilating urea; (4) *C. guilliermondi* group (including *C. guilliermondi* and *C. chalmersi*), fermenting glucose and saccharose, not maltose or lactose, negative urea auxanagram; (5) *C. krusei* group (including *C. krusei*, *C. parakrusei*, and *C. aldoi*), fermenting only glucose and levulose; (6) *C. brumpti* group (including *C. brumpti* and *C. flareri*), fermenting glucose weakly and levulose very weakly, and not assimilating urea; and (7) the azymatic group, not fermenting any sugar, which consists of *C. zeylanoides*, *C. deformans*, and *C. suaveolens*.

Ambrosioni (P.). **Allantospora violacea n.sp. ritrovata in un caso di erosione interdigitale.** [*Allantospora violacea* n.sp. detected in a case of interdigital eruption.]—*Riv. Parasitol.*, ii, pp. 151–158, 1938. [Abs. in *Zbl. Haut- u. GeschlKr.*, lxi, 3, p. 118, 1939.]

A Latin diagnosis is given of *Allantospora violacea* n.sp., isolated at the Microbiological Institute, Rome University, from an eruption of the interdigital spaces and soles of the feet.

Durham (O. C.). **Incidence of air-borne fungus spores. II. Hormodendrum, Alternaria, and rust spores.**—*J. Allergy*, x, 1, pp. 40–49, 2 figs., 1 graph, 1 map, 1938.

Further studies on the incidence and distribution of *Alternaria* and *Hormodendrum* spores at different seasons in all parts of the United States [*R.A.M.*, xviii, p. 108] and certain localities (Winnipeg and Toronto) in Canada indicate that the total figures for the two groups are approached by none of the other larger air-borne spores except those of the rusts and smuts. At times *Aspergillus*, *Penicillium*, and *Phoma* spores also occur in large numbers on the trap slides, but in most cases there is good evidence of the multiplication of these organisms after they reach the slide. A map depicts the striking similarity in the quantitative geographical distribution of *Alternaria* and *Hormodendrum* not only as compared with one another but also in relation to ragweed [*Ambrosia artemisifolia*], an abundance of one of the three showing a correlation with the profuse development of the other two. In this connexion, attention is drawn to the comparable soil and moisture requirements of wheat and ragweed. The latter being definitely excluded as a host of the two fungus groups under discussion, it is suggested that the straw of wheat and other small grains may well afford an ideal natural substratum for the growth of these moulds. The maximum production of both *Alternaria* and *Hormodendrum* is reached in the north-central States and the minimum in the arid region west of the Rocky Mountains. The three months of heavy production are the same both in the north and south, viz., July, August, and September. From the data so far obtained *Hormodendrum* is generally more abundant than *Alternaria* in May and June, while in November the positions are reversed. Detailed statistics for the evaluation of the spores of these moulds as sources of inhalant allergy are presented in tabular form.

During 1937 two distinct heavy showers of stem rust of cereals [*Puccinia graminis*] were observed, the first about 12th June in central

Oklahoma, eastern Kansas, eastern Nebraska, Missouri, Illinois, and Indiana from winter wheat, and the second and more severe in Minnesota from spring wheat during July, when the maximum number of spores trapped at Moorhead (on 22nd) was 10,000.

GRIGORAKI (L.) & DAVID (R.). **Complément à l'étude des caractères biochimiques de Trichophyton crateriforme et Achorion violaceum.** [Supplement to the study of the biochemical characters of *Trichophyton crateriforme* and *Achorion violaceum*.]—*C. R. Soc. Biol., Paris*, cxxix, 30, pp. 647–649, 1938.

A study of the action of *Trichophyton crateriforme* and *Achorion violaceum* [*R.A.M.*, xvii, p. 818] on glucids and glycerine by means of the 'litmus test' showed that the colour shades (Klincksieck and Valette) produced by the former on glucose, mannose, galactose, saccharose, lactose, maltose, inulin, dextrin, and glycerine were orange-yellow 156, orange 136, orange 136, purple-red 553, violet 502, violet 526, violet-red 553, violet-red 553, and violet 506, respectively, the corresponding tones for the latter being red 31, red 11, red 11, violet-red 576, violet-red 577, violet-red 577, violet-red 577, violet-red 582, and violet-red 556, respectively.

SEMENIUK (G.) & BALL (W. C.). **Some moulds associated with meat in cold storage lockers in Iowa.**—*Proc. Ia Acad. Sci., 1937*, xliv, pp. 37–43. [? 1937. Received December, 1938.]

The following moulds have been isolated from meat in cold storage locker plants in Iowa: *Thamnidium elegans*, *T. chaetocladioides* [*R.A.M.*, xiii, p. 442], *Cladosporium herbarum* [ibid., xiii, p. 701], four strains of the *Aspergillus glaucus* [ibid., viii, p. 785] group (comprising *A. repens*, *A. ruber*, and *A. chevalieri*), seven cultures of the *asymmetrica-velutina* group of *Penicillium*, and strains approximating to *P. chrysogenum*, *P. notatum*, *P. puberulum* [ibid., xiii, p. 514], and *P. melinii*. It is pointed out that since meat is frequently stored in these lockers for six months or a year at fluctuating temperatures, sometimes exceeding the critical degree for mould development of 32° F., an improvement in the present system is urgently necessary in the public interest.

CALINISAN (M. R.). **Transmission experiment of Abacá mosaic. (Progress report No. 1.)**—*Philipp. J. Agric.*, ix, 3, pp. 309–312, 3 pl., 1938.

Mosaic disease of *Musa textilis* [*R.A.M.*, xvii, p. 40], first observed by the author in the Philippine Islands in 1933, has now become one of the major diseases of this host locally. Attempts at transmission under greenhouse conditions through soils, by contact, and by inoculation, all gave negative results. When, however, five healthy plants of two varieties and a potted healthy seedling were planted in the greenhouse side by side with other infected plants heavily infested with *Pentalonia nigronervosa*, only one plant failed to develop mosaic symptoms. The evidence thus appears to indicate that *P. nigronervosa* plays some part in transmission, though further experiments are necessary in this regard.

Calinisan (M. R.). **The three destructive diseases of Abacá in Davao (bunchy-top, mosaic, and the vascular disease) and their control.**—*Philipp. J. Agric.*, ix, 3, pp. 329–333, 3 pl., 1938.

Short, popular notes are given on the symptoms, causes, and control of the three chief diseases of abacá [*Musa textilis*] occurring in Davao, Philippine Islands, viz., vascular disease or wilt [? *Fusarium oxysporum* var. *cubense*: *R.A.M.*, xviii, p. 30], bunchy top [ibid., xvii, p. 40], and mosaic [see preceding abstract].

Vinogradoff (V. P.), Kapustina (Mme E. I.), Popova (Mme T. T.), & Shevtchenko (A. N.). Методика определения посевных качеств и фитопатологической экспертизы семян Льна. [Instructions for the determination of the germinative value of Flax seeds and for their phytopathological examination.]—80 pp., 26 figs., Госуд. Издат. Колх.-совх. Литер. „Сельхозгиз" [St. Publ. Off. Lit. collect. co-op. *Fmg* 'Selkhozgiz'], Moscow, 1937. [Received November, 1938.]

Official instructions approved by the Pan-Soviet Scientific Research Institute of the Flax Industry are given in this booklet for the determination of the germinability of flax seed and its freedom from contaminating organisms. A brief account is added of the chief fungi and bacteria usually present on the flax seed, such as *Fusarium* spp., *Ascochyta* [*linicola*: *R.A.M.*, xv, p. 369], *Polyspora* [*lini*: ibid., xviii, p. 111], *Colletotrichum lini* [loc. cit.], a 'fungus sterilis', and various saprophytes. The sterile fungus is stated to cause a brick-red spotting on the cotyledons and a streaking of the same colour on the radicles; heavily infected seed usually damps off, but slight contamination is not dangerous.

Wilson (R. D.). **A bacterial disease of Stocks.**—*J. Aust. Inst. agric. Sci.*, iv, 4, pp. 212–215, 1 fig., 1938.

During 1938, stocks (*Matthiola incana* var. *annua*) growing in various localities in New South Wales were affected by a bacterial disease apparently new to Australia, which caused heavy losses in some plantings. The affected plants were stunted, and the lower leaves turned yellow and dropped off; in severe cases, the plants wilted, and often died. Black, sunken, water-soaked lesions appeared at the points of attachment of the leaves to the stem and of the subsidiary stems to the main stem. Internally, the vascular area and the adjacent tissues were blackened.

Inoculations of stock seedlings, made by means of needle punctures on the stems, gave rise to typical symptoms, and the organism was reisolated. Inoculations on other crucifers were unsuccessful. The organism is a Gram-negative, non-spore-forming, aërobic rod measuring 1·5 to 3 by 0·6 to 0·9 μ, motile by one polar flagellum, producing a copious yellow growth on beef extract peptone agar and potato dextrose agar, hydrolysing starch, liquefying gelatine, not producing indol from tryptophane broth, and not reducing nitrates to nitrites. Growth occurred on a solid medium with the production of acid when dextrose, sucrose, galactose, raffinose, levulose, xylose, arabinose, mannose, mannitol, glycerol, and maltose were used as the sources of carbon.

The disease is probably the same as that recently recorded by Ken-

drick from California [abs. in *Phytopathology*, xxviii, 1, p. 12, 1938], and the causal organism is probably closely related to, but not identical with, *Bacterium campestre* [*Pseudomonas campestris*: see next abstract].

Burkholder (W. H.). **A bacterial blight of Stocks caused by Phytomonas syringae.**—*Phytopathology*, xxviii, 12, pp. 935–936, 1938.

Inoculation experiments with two virulent strains of *Phytomonas* [*Pseudomonas*] *syringae* [*R.A.M.*, xviii, p. 154], one from lilac and the other from Lima beans [*Phaseolus lunatus*], on flowering stocks (*Matthiola incana* var. *annua*) in the greenhouse at Cornell University, New York, resulted in the development of symptoms identical with those described by Briosi and Pavarino from Italy and Adam and Pugsley from Victoria as due to *Bacterium matthiolae* [ibid., xiii, p. 747]. Simultaneous inoculations of stocks with *Phytomonas* [*Bact.*] *maculicola* from cauliflower gave negative results. It is apparent from the outcome of these tests that the stock is one of the many hosts of *Pseudomonas syringae*, of which *Bact. matthiolae*, in view of the close similarity of its symptoms, is believed to be a synonym. On the other hand, a disease of stocks reported by Kendrick from California [cf. preceding abstract] caused by a pathogen similar in appearance to, but not identical with, *Phytomonas* [*Pseudomonas*] *campestris*, is distinct.

McWhorter (F. P.). **Correlation between self-breaking and blue nuclei among certain commercial Tulip varieties.**—*Science*, N.S., lxxxviii, 2287, p. 411, 1938.

Recent studies on the new race of Mendel tulips have shown that every red variety bearing flowers with a white ground and blue base self-breaks or darkens when inoculated with tulip virus I (colour-removing) [*R.A.M.*, xvii, p. 603]. Of 49 red varieties investigated, 21 reveal a blue pigment in the epidermis of the basal portion occurring (1) free in the cytolymph of the epidermal cells, (2) as prismatic crystalline masses, (3) within the nuclei of the cells, or (4) in combinations of these three positions. The nuclei are often so blue as to disclose no structural characters. Nuclear pigmentation reaches a climax in cells in a state of incipient degeneration, but is also evident in apparently sound material. Blue nuclei are found in the bases of red Darwin tulips, which also self-break in the presence of the colour-removing virus.

Schander (H.). **Untersuchungen über die Abhängigkeit der Jugendchlorose von Lupinus luteus von Aussenfaktoren während ausschliesslicher Ernährung durch die Keimblätter in Wasserkultur. 1. Die Wirkung einzelner Salze und der Reaktion. 2. Die Wirkung der Reaktion und Salzkonzentration der Nährlösung.** [Studies on the dependence of the juvenile chlorosis of *Lupinus luteus* on external factors during exclusive nutrition through the cotyledonary leaves in water culture. 1. The influence of individual salts and the reaction. 2. The influence of the reaction and salt concentration of the nutrient medium.]—*Bodenk. u. Pfl-Ernähr.*, N.S., xi, 1–2, pp. 32–49; 5–6, pp. 278–283, 22 graphs, 1938.

A fully detailed account is given of the methods specially devised by the author, at the Kaiser Wilhelm Institute for Breeding Research,

Müncheberg, Mark, Germany, for the determination of juvenile chlorosis in three selected strains of Weiko yellow lupins (*Lupinus luteus*) [*R.A.M.*, xvi, p. 42] and the influence on the disorder of various compounds of calcium, magnesium, sodium, potassium, ammonium, and strontium. The results of the water culture tests showed that no chlorosis develops at the optimum reaction for the growth of the plant (P_H 4·8 to 5), but beyond these limits the symptoms occur in varying intensity in the presence of the individual salts, increasing parallel with distance from the optimum in the case of a constant salt concentration, and with a rising concentration where a constant reaction is maintained. The severity of the disease was also found to depend on the nature of the active cations of the salts, the adverse effects of which operated through the following descending scale: ammonium, magnesium, calcium, potassium, sodium, and strontium.

Weihing (R. M.), Robertson (D. W.), & Coleman (O. H.). **Survival of several Alfalfa varieties seeded on irrigated land infested with bacterial wilt [Phytomonas insidiosa (McCulloch) Bergey et al.].**—*Tech. Bull. Colo. agric. Exp. Sta.* 23, 12 pp., 1 diag., 1938.

Ten trials of different varieties of lucerne on land infested with bacterial wilt (*Phytomonas insidiosa*) [*Aplanobacter insidiosum*: *R.A.M.*, xvii, p. 301] were conducted on various experimental farms in Colorado, where the plants were grown in one-tenth or one-half acre plots, two permanent quadrates, 1 m. sq., being reserved in each plot for making spring and autumn stand counts. The first count made in the autumn of the first year of harvesting, when all the stands were thick enough for excellent hay yields, showed an average of 46·4 plants per quadrate for the ten tests. In seven tests in which the initial counts averaged 43·7 plants per quadrate, the autumn counts of the third harvest year averaged 19·4 plants and the stands were too thin for further hay production. In these seven tests there was a consistent decrease of 6·1 plants per quadrate between successive spring and autumn and autumn and spring counts. In the following spring stand counts in four of these tests averaged 9·8 plants per quadrate. One test with four varieties averaged 48·4 and 16·2 plants per quadrate for the initial and the fourth autumn counts, respectively, while two tests averaged 55·1 and 22·1 plants per quadrate for the initial and fifth autumn counts, respectively. Thus, most varieties were too thin for hay production after the third or fourth year of harvesting, with the exception of Hardistan, which survived and remained productive for one or even two or more further years, the commercial strain No. 2674 from Turkestan coming next. The survival of Chilean and Argentine was as low as that of any of the varieties, and there seemed to be little difference in the average survival of variegated and common strains of lucerne.

Porchet (Berthe). **Contribution à l'étude de la levure Torulopsis pulcherrima.** [A contribution to the study of the yeast *Torulopsis pulcherrima*.]—Reprinted from *Ann. Ferment.*, N.S., iv, 7, 20 pp., 21 figs., 1938.

A detailed description is given of the author's comparative study of

ten strains of *Torulopsis pulcherrima* [cf. *R.A.M.*, xiv, p. 523; xvii, p. 676] obtained from cherries, plums, apples, and grapes in Switzerland. Six strains showed all the characteristics described by Lodder for the species [cf. ibid., xiv, p. 193], but of the remainder, one had a distinct pseudomycelium on wort, another showed the presence of conidia at the extremity of the cellular prolongations, and a third gave two types of colonies. These four aberrant strains had certain characters connecting them with the Mycotoruloideae.

Siemaszko (W.). **Brudna plamistość Jabłek powodowana przez grzyb Gloeodes pomigena (Schw.) Colby.** [Sooty blotch of Apples caused by the fungus *Gloeodes pomigena* (Schw.) Colby.]—*Roczn. Nauk ogrod.*, iv, pp. 57–63, 4 figs., 1937. [English summary. Received February, 1939.]

Gloeodes pomigena [*R.A.M.*, xvi, p. 758] was first observed in Poland in 1934 on market apples of the Graham Pippin variety, but also occurred in 1937 in other localities on Harbert's and Landsberg Pippins and later on fruit in cold storage in Warsaw. It was sometimes observed in association with the fly speck fungus *Leptothyrium pomi*, but more often the latter was found alone.

Blodgett (F. M.). **The spread of Apple mosaic.**—*Phytopathology*, xxviii, 12, pp. 937–938, 1938.

Of 1,207 apple trees in nine orchards in New York State surveyed in 1927 and still extant in 1932, 72 showed symptoms of mosaic [*R.A.M.*, xvi, p. 687] in the former and 109 in the latter year, representing a 51·4 per cent. increase over the five-year period. At the close of a further five-year period, 163 out of 981 trees were diseased compared with 96 in 1932, an increase of 69·8 per cent. Of 914 trees examined both in 1927 and 1937, 138 showed mosaic at the end of the ten-year period as against 31 at the beginning. All these differences, when analysed by the X^2 test, are significant. The somewhat slow spread of the disease is believed to be associated with pruning operations rather than with insect transmission.

Goldsworthy (M. C.) & Smith (M. A.). **An Apple leafspot associated with Fabraea maculata.**—*Phytopathology*, xxviii, 12, p. 938, 1938.

In June, 1938, pear, French crab apple, and McIntosh apple leaves were observed at the United States Horticultural Station, near Beltsville, Maryland, to bear the black, blister-like acervuli of *Fabraea maculata* [*R.A.M.*, xvi, p. 759; xviii, p. 38, and below p. 261], and microscopic examination disclosed the presence of the typical *Entomosporium* [*maculatum*] conidia in the lesions on all three hosts.

Yossifovitch (M.). **Puccinia pruni-spinosae Persoon.** Прилог проучавању сузбијања рђе на Шљиви. [*Puccinia pruni-spinosae* Persoon. A contribution to the study of the control of rust on Plums.]—*Ann. Trav. agric. sci., Belgrad*, v, 12, pp. 49–59, 2 figs., 1938. [French summary.]

Rust of plums, caused by *Puccinia pruni-spinosae* [*R.A.M.*, xviii,

p. 190], is stated to occur regularly in Yugoslavia, causing in some years (e.g., 1936) very serious damage and complete defoliation of the trees, especially of the most important variety Požegača (Hungarian domestic plum).

The results of spraying experiments on this variety, conducted in 1938 in a village of the Kosmaj district, showed that the success of treatment with Bordeaux mixtures depended on the date of application. Spraying either on 27th May or 18th June with a 2 per cent. Bordeaux mixture and 2 per cent. skim milk gave complete control of the disease, whereas earlier applications had little or no effect. The spraying prevented both the primary infection by aecidiospores and the secondary infection by uredospores. It has thus been demonstrated that complete control of rust can be achieved by one treatment, provided it is applied when the foliage is almost completely developed.

COCHRAN (L. C.) & HUTCHINS (L. M.). **Further studies on host relationships of Peach mosaic in southern California.**—*Phytopathology*, xxviii, 12, pp. 890–892, 1 diag., 1938.

Almond, apricot, plum, and prune mosaics [cf. *R.A.M.*, xviii, p. 188], occurring spontaneously in southern California, have already been shown to produce peach mosaic-like symptoms on peach after graft inoculations, and the present paper gives further details of observations and experiments on the host relationships of peach mosaic.

In September, 1937, healthy apricot nursery trees were grafted with buds from mosaic-diseased peaches. Growth from the inserted peach buds showed severe mosaic symptoms in the following spring, whereas the apricot portion remained apparently healthy, though peach scions grafted on the apricot limbs the following spring developed mosaic, showing that the virus was present in the apricot without inducing external manifestations of the disease. Plums and prunes behaved in a similar manner to the apricot.

Further data show that the peach mosaic virus may be present in a latent form in almond for at least three years. Naturally occurring almond, apricot, and prune mosaics were transmitted from infected to healthy trees of the respective species, the incubation period approximating to that of peach mosaic in peach. Apricot mosaic was transmitted by grafting to peaches and vice versa. Spontaneous mosaic in the almond, inoculated into healthy apricots, caused typical apricot mosaic in the latter. Surveys of commercial plum and prune orchards adjoining peach orchards with 75 per cent. mosaic disclosed no signs of infection in the two first-named, and grafting tests showed them to be free from peach mosaic.

It is apparent from these data that, while certain naturally occurring almond, apricot, and plum disorders of the mosaic type are capable of producing peach mosaic-like symptoms in peach by graft inoculations, a reciprocal relationship may not hold good. Almonds, apricots, and plums may serve as symptomless carriers of the peach mosaic virus acquired by inoculation. Further experiments are necessary to determine whether there is actually more than one mosaic virus of *Prunus* spp. in California, as the available evidence would appear to indicate.

Schneiderhan (F. J.). **Control of Cherry leaf-spot in West Virginia.**—*Bull. W. Va agric. exp. Sta.* 288, 13 pp., 5 figs., 1938. [Abs. in *Exp. Sta. Rec.*, lxxx, 1, p. 65, 1939.]

If neglected, cherry leaf spot (*Coccomyces hiemalis*) [*R.A.M.*, xvii, pp. 608, 694] causes defoliation, yield reduction, and devitalization of the trees, predisposing to winter injury, in West Virginia, where the fungus overwinters in the dead leaves, producing ascospores as a source of primary infection about blossom time. Secondary infection is spread by the conidia formed in the foliar lesions. Ascospore discharge records indicate that infection may take place before the petal-fall spray, hitherto the first applied under local conditions. The results of two years' tests have shown that a pre-blossom fungicidal treatment is as likely to prevent spring attacks of leaf spot as the petal-fall application, while a post-harvest spray should also be given to counteract late infection (which was extremely heavy in August and September from 1934 to 1937) and abundant carry-over of the fungus.

McWhorter (O. T.). **Zinc helps combat "little leaf" in fruit trees.**—*Bett. Fruit*, xxxiii, 5, p. 15, 1938.

Little leaf of fruit trees [*R.A.M.*, xvii, p. 692; xviii, pp. 43, 187] was successfully controlled by means of zinc sulphate sprays, zinc glazier tacks, and zinc sulphate injections in over 300 demonstrations and trials in Oregon. Zinc sulphate, applied as a dormant spray at the rate of 50 lb. in 100 gals. water at four-day intervals on cherry trees at the time of bud opening, caused no damage to buds or foliage, although under certain conditions such sprays may be injurious at this stage. Excellent results were obtained with 18 to 25 lb. zinc sulphate in 100 gals. water applied as a foliage spray in May, June, and early July, either with or without lime (1 lb. to each 3 lb. zinc sulphate). Zinc sulphate sprays applied at the rate of 12 lb. per 100 gals. water with spreader gave as complete control within 40 days as did zinc sulphate at the rate of 25 lb. without spreader, and good control was also obtained with 6 lb. with spreader. Foliar injury occurred when spraying with zinc sulphate and spreader on 16th June was followed within 48 hours by rain and wind, severe damage (40 to 50 per cent. of the leaves turning yellow and dropping) being observed in the case of spreader and 12 to 18 lb. per 100 gals., and slight in that of spreader and 3 or 6 lb. per 100 gals. The results of experiments conducted at The Dallas in Wasco County, Oregon, seem to indicate that boron and zinc sulphate used together give a more lasting control of little leaf.

Moore (M. H.). **Leaf blight on Medlar in England.**—*Gdnrs' Chron.*, civ, 2712, pp. 440–441, 2 figs., 1938.

A semi-popular note is given on an attack of leaf blight (*Entomosporium maculatum*) on medlars (*Mespilus germanica*) in a Kentish garden in July, 1938; this is stated to be only the second record of the disease in England, where the perfect stage of the fungus (*Fabraea*) [*maculata*: *R.A.M.*, xvii, p. 507; xviii, p. 259] has not yet been observed. Briefly discussing the complex problem of physiologic specialization in *F. maculata*, the writer thinks the available evidence points to the inclusion of the strains on different hosts within the one species, with

the possible exception of that occurring on *Crataegus*. The medlar strain is not definitely known to be transmissible to other hosts, but probably any one of the three fruits, quince, medlar, and pear, is a potential source of infection of the other two.

WORMALD (H.). **The Septoria leaf-spot disease of Black Currants.**—*Gdnrs' Chron.*, civ, 2711, pp. 424–425, 6 figs., 1938.

Mycosphaerella ribis, also known [by the earlier name] as *M. grossulariae* [*R.A.M.*, xvii, p. 331], was observed in the conidial stage (*Septoria ribis*) in North Wales in August, 1938, causing severe infection of black currants and destroying large areas of the leaf surface. The symptoms and life-history of the fungus are briefly described in popular terms, with special reference to the differentiation of the resultant leaf spot from the more common one due to *Pseudopeziza ribis*.

HEWITT (W. B.). **Leaf-scar infection in relation to the Olive-knot disease.**—*Hilgardia*, xii, 1, pp. 41-72, 2 figs., 2 diags., 4 graphs, 1938.

In experiments on the infection of leaf scars with the olive knot organism (*Bacterium* [*Pseudomonas*] *savastanoi*) [*R.A.M.*, xvi, p. 548], carried out during 1935 to 1937 in an orchard in Sacramento County, California, on the Mission variety, 225 out of 241 knots which developed on tagged branches were situated on leaf scars, and 229 out of 339 leaf scars, exposed by removing yellow leaves nearly ready to fall, developed knots.

When the base of the petiole of a number of leaves was inoculated on two different dates before leaf fall with a water suspension of *P. savastanoi*, only two out of 50 and two out of 67 leaf scars, respectively, developed knots, indicating that natural infection of leaf scars rarely occurs before leaf fall. A microchemical and histological examination of the abscission zone before and after leaf fall showed that no protective layers are formed before the separation of the leaf, so that at leaf fall the scar is an open wound with exposed tissues and open vessels. During the healing process a wound gum layer is formed followed by the development of a periderm. Inoculations of leaf scars made immediately after leaf fall produced a high incidence of infection both in scars kept in a moist chamber and those left outside; the susceptibility decreased rapidly during the first day after leaf fall, and was entirely lost on the fifth and the ninth day in shoots kept inside and outside the moist chamber, respectively. It is assumed that under normal weather conditions in California about 80 to 95 per cent. of the leaf scars would be susceptible to infection at the time of leaf fall, 40 per cent. on the fourth day, while most scars would be immune by the end of the ninth day.

India ink applied to fresh leaf scars penetrated comparatively deeply into the vessels of the scar, while in scars half-an-hour old it penetrated only a short distance, and the depth of penetration thereafter decreased with the increasing age of the scar. It is concluded from these results that the high percentage of infection in scars inoculated immediately after the removal of the leaves may result from the deep penetration of the inoculum at that time. Most infections in the leaf scars were

caused by bacteria that entered the tissues through vessels, whence they were liberated into the other tissues of the scar when the developing periderm pulled the vessels apart. Bacteria entering the leaf scar tissue through intercellular spaces progressed slowly and were stopped by wound gum that plugged these spaces. The bacteria formed pockets in the tissues derived from the phellogen, and the greatest amount of cell division occurred in the region of these bacterial pockets.

Reichert (I.) & Hellinger (Esther). **Dothiorella rot of Bananas and Oranges in Palestine.**—*Palest. J. Bot.*, R Ser., ii, 1, pp. 79–88, 1 pl., 1938.

A full description is given of a banana disease of some economic importance attributed to a species of *Dothiorella* observed for the first time towards the end of 1929 in the Jaffa-Tel Aviv district of Palestine [a preliminary account of which appeared in Wardlaw's book on banana diseases (pp. 260–263): *R.A.M.*, xiv, p. 322]. It is a typical tip-end rot, slowly progressing towards the stem end. The blackening of the decayed parts is preceded by a narrow, brown, watery margin forming a sharp line of demarcation between sound and infected tissues. The spores are forcibly expelled *en masse* and remain as a fine particle of white powder above each pycnidium, constituting a characteristic feature of the disease. The thick-walled, globose, black pycnidia of the fungus measure 141 to 323 by 414 to 242 μ and contain ovoid or fusoid, hyaline, thin-walled spores, 13 to 21 by 4 to 7 (average 16 by 5) μ. The rot is most prevalent under the humid conditions of winter, but may also occur to a limited extent at higher temperatures, successful inoculations having been made in June at 25° to 27° C.

At the close of the 1930–1 orange season a black rot of the fruits closely resembling that due to *Diplodia* [*natalensis*] was observed. Isolation experiments on potato dextrose agar resulted in the development of pycnidia and spores of a *Dothiorella* agreeing in essentials with that from banana, and also of sporocarps, 435 to 500 by 340 to 450 μ, embedded in black, raised, hard stromatic masses and in some cases containing asci, each occupied by eight spores, 14·5 to 19 by 5 to 8·5 (15 by 6·8) μ. Reculturing the fungus yielded only the perithecial stage. The banana species, cross-inoculated on green orange, produced a black rot macroscopically indistinguishable from that caused by *Diplodia natalensis*, but typical *Dothiorella* pycnidia were formed on the fruits. The orange *Dothiorella* caused a decay of bananas in moist chambers agreeing in all respects with that of the same fungus from banana, the pycnospores on the fruit measuring 12 to 20 by 3·5 to 6 (16 by 5) μ.

Discussing at some length the taxonomic position of the *Dothiorella* on banana and morphologically similar species recorded on citrus and other fruits, the writers conclude that all are closely related to *D. gregaria*, the imperfect stage of *Botryosphaeria ribis* [ibid., xv, p. 238; xviii, p. 148]. The perfect stage of the Palestine citrus *Dothiorella* is also nearly allied morphologically to *B. ribis*, but differs from the latter in its failure to develop a pink coloration on starchy media.

Control measures, based on plant sanitation and the use of an ammoniacal copper carbonate spray, are briefly indicated.

Hirai (T.). **Studies on the Sclerotium disease of Bananas.**—*Ann. phytopath. Soc. Japan*, viii, 3, pp. 212–229, 3 figs., 1938. [Japanese, with English summary.]

Comparative studies of the strain of *Corticium centrifugum* isolated from bananas [*R.A.M.*, xviii, p. 41] and five others derived from various plants indicated a closer relationship between the first-named and the rocambole [*Allium scorodoprasum*] strain than between the banana and clover isolates. Both the hyphae and sclerotia of the fungus are capable of attacking wounded or uninjured banana fruits under favourable conditions. The optimum temperature for sclerotial germination seemed to lie within the wide range from 24° to 36° C.; the process requires a relative atmospheric humidity exceeding 97 per cent., this factor being of greater importance than temperature in the writer's tests. Mycelial growth was most profuse between 28° and 32°, declined considerably at 20°, and practically ceased round about 11°, so that the maintenance of this temperature in the refrigerator, as in the case of other transport diseases of banana [loc. cit.], is likely to prove an effective means of control.

Magee (C. J.) & Foster (E. P.). **Banana leaf spot. Summer treatment gives promising results.**—*Agric. Gaz. N.S.W.*, xlix, 12, pp. 662–664, 1 fig., 1938.

Under the conditions prevailing in New South Wales, fair to good control of banana leaf spot (*Cercospora musae*) [*R.A.M.*, xviii, p. 192] with normal maturation of the bunches was given by Bordeaux mixture (1–1–10) with agral III spreader in mid-January and February, mid-January and April, mid-December, February, and April, and by copper-lime dust (20–80) applied each month from mid-December to mid-April, while excellent control resulted from monthly applications of Bordeaux mixture (1 1–10) and agral III from mid-December to mid-April, there being practically no spotting present. In another locality, monthly applications of Bordeaux mixture (1–1–10) with agral III from mid-December to mid-April also gave excellent control. The same treatment applied in a third locality on 29th January and 28th February, 29th January and 28th April, fortnightly from mid-December to 11th May (8 applications), monthly from mid-December to 11th May, and on 22nd December, 1st March, and 5th May in all cases gave control, the results being excellent in the case of the fortnightly and monthly spraying. In all three tests the unsprayed controls showed medium to severe infection.

These results show that under the local conditions banana leaf spot can be controlled by fungicidal applications in summer. Almost complete absence of leaf-spotting results from five applications of Bordeaux mixture at monthly intervals, or from fortnightly applications. Two sprays at an interval of one or two months, beginning in mid-December, will suffice to give practical control.

Thompson (A.). **A root disease of the Durian tree caused by Pythium complectens Braun.**—*Malay. agric. J.*, xxvi, 11, pp. 460–464, 1 pl., 1938.

In 1938, about 50 durian trees (*Durio zibethinus*) on a small estate

in Singapore became affected, singly and in groups, by a root disease due to *Pythium complectens* [cf. *R.A.M.*, xvii, p. 294], a number shortly afterwards succumbing. Severely affected trees showed a brown discoloration and decay of the bark at and just above soil-level, but no definite symptoms of patch canker [*Phytophthora palmivora*: ibid., xiv, p. 46]. In early stages, the upper lateral roots were healthy, but the lower laterals showed a decay on one side extending from the tips along the cortex and wood to the tap root. In later stages, the decay had spread to the tap root and was about to 'ring' the cortical tissue at the collar; the wood was dry, soft, pinkish, and flecked with brown.

Inoculations of wounded stems and wounded and sound roots of healthy durian trees gave positive results, the fungus being reisolated from the cortex and wood. The progress of the fungus was slower in roots than in the stem inoculations. It is considered that the fungus is a facultative parasite of roots growing in a soil of reduced fertility.

Control measures recommended consist in extirpating and burning the affected trees, removing the lateral roots, and isolating the affected areas by trenching. The lateral roots of trees adjacent to diseased trees should be inspected, and any cut ends protected with a wound dressing. Cattle manure, compost, or organic matter should be incorporated with the soil when filling in the trenches preparatory to replanting.

Carneiro (J. G.). **Nomenclatura phytopathologica e mycologica brasileira.** [Brazilian phytopathological and mycological nomenclature.] —Reprinted from *Bol. Agric., S. Paulo, 1937*, 51 pp., 1938. [Received February, 1939.]

An alphabetical list, intended to supplement that compiled in 1931 by E. Rangel [*R.A.M.*, x, p. 743], is given of a number of Latin and other foreign terms in current use in Brazilian phytopathological and mycological literature, with their Portuguese equivalents.

Doyer (Lucie C.). **Manual for the determination of seed-borne diseases.** —59 pp., 33 pl. (18 col.), International Seed Testing Association (H. Veenman & Zonen, Wageningen, Holland), 1938. Fl. 5.

This clearly written and attractively presented manual on the methods of determination of seed-borne diseases of agricultural, kitchen-garden, horticultural, and miscellaneous crops employed at the Dutch State Seed Testing Station is divided into two parts, general and special. The former comprises generalities on the technique of macroscopic and microscopic examination and on the control of superficial seed-borne infection by cleaning or disinfection, while the special part deals at greater length with individual diseases and pests of the various crops under discussion. A table is appended showing the infections to be determined by (*a*) direct inspection of the original dry samples (in part), (*b*) observation of the seeds or seedlings in germination beds, and (*c*) shaking the seeds in water or other liquids. Particular mention should be made of the exceptionally good coloured and photographic reproductions accompanying the volume in the form of loose plates.

Barss (H. P.). **Danger in unguarded seed importation.**—*Phytopathology*, xxviii, 12, p. 939, 1938.

Notwithstanding various attempts to enlighten the agricultural public

on the risks attendant on indiscriminate seed importation [*R.A.M.*, xi, p.386 *et passim*], the importance of this means of spreading dangerous plant diseases is not generally recognized. As a recent example of potentially grave significance may be mentioned the detection of a new cotton anthracnose (*Colletotrichum* sp.) in Manchukuo (*J. Sapporo Soc. Agric. For.*, xxix, pp. 27–45, 1938), the introduction of which into the United States might well lead to serious consequences. Two such introductions already causing damage are mint anthracnose [*Sphaceloma menthae*: ibid., xvii, p. 485] and potato tuber ring rot and wilt [*Bacterium sepedonicum*: ibid., xviii, p. 53].

Pfankuch (E.) & Kausche (G. A.). **Über Darstellung, Eigenschaften und quantitative Bestimmung von Tabakmosaik-Virus und Kartoffel-X-Virus und ihre physikochemische Differenzierung.** [On the preparation, properties, and quantitative determination of the Tobacco mosaic and Potato X viruses and their physico-chemical differentiation.]—*Biochem. Z.*, ccxcix, 5–6, pp. 334–345, 3 figs., 1 graph, 1938.

This is a fully detailed, tabulated account of the writers' work in the development of highly purified preparations of the tobacco mosaic and potato X viruses, the essential features of which have already been noticed from other sources [*R.A.M.*, xvii, p. 832].

Allington (W. B.). **The separation of plant viruses by chemical means.**—*Phytopathology*, xxviii, 12, pp. 902–918, 3 figs., 1938.

Of 35 chemical compounds tested for their inactivating effect in one hour at 20° C. on the viruses of tobacco mosaic (tobacco virus 1), cucumber mosaic, potato ring spot [*R.A.M.*, xvii, p. 544], potato vein-banding, tobacco ring spot [ibid., xviii, p. 61], and tobacco streak [ibid., xvii, pp. 210, 274], the following were amongst the most powerful: mercuric chloride (minimum concentrations for total inactivation over 3, 0·8, 0·1, 0·5, 0·6, and 0·1 per cent., respectively), silver nitrate (4, over 2, 1, 0·5, 1, and over 1), copper sulphate (over 6, 1·8, 2, 2·5, 1, and 0·2), lithium carbonate (over 1, usually 1, 1, over 1, 1, and 1), phenol (usually 5, 5, usually 5, 5, 4, and 2), formalin (over 50, 1, 1, 1, over 0·5, and 1), nitric acid (2, 0·6, 0·4, 0·9, 0·3, and 0·5), sodium hydroxide (0·3, 0·2, 0·1, 0·3, 0·2, and over 0·1), sodium permanganate (usually 1·5, 0·5, 0·1, 1, 0·5, and 0·2), and potassium permanganate (1·5, 0·4, 0·4, 0·8, 0·2, and 0·2).

On the basis of their differential reactions to chemical treatment, it was possible to separate the two components of four virus mixtures, viz., cucumber mosaic and potato ring spot (by silver nitrate, mercuric chloride, potassium permanganate, copper sulphate, and lithium carbonate at appropriate dilutions), potato ring spot and potato vein-banding (by mercuric chloride, potassium permanganate, sodium hydroxide, and nitric acid), cucumber mosaic and tobacco ring spot (by mercuric chloride and phenol), and tobacco mosaic (1 in 100) and tobacco ring spot (by phenol and sodium permanganate).

Levaditi (C.). **Les ultravirus.** [The ultra-microscopic viruses.]—*Bull. Soc. Enc. Industr. nat., Paris*, cxxxvii, 1–2, pp. 27–42, 1938.

In this well-informed and fully documented survey of the ultra-

microscopic virus problem, the author critically discusses some important points connected with the properties (pathogenicity, filterability, reaction to chemical agents, dimensions, and so forth) and nature of viruses and bacteriophages.

McComb (A. L.). **The relation between mycorrhizae and the development and nutrient absorption of Pine seedlings in a prairie nursery.** —*J. For.*, xxxvi, 11, pp. 1148–1154, 3 figs., 1938.

In 1937 a new tree nursery was established at Ames, Iowa, on an area that had been farmed for many years, situated on O'Neil sandy loam soil with a gravel subsoil. Various species of pine were included in the coniferous section (P_H 6 to 6·2), four of which, northern white pine (*Pinus*) [*strobus*], *P. ponderosa*, Japanese red [*P. densiflora*], and Virginia (*P. virginiana*), were mulched with pine needles from an adjacent plantation. In the middle of the first growing season many of the seedlings turned brown to reddish-purple and entirely ceased growth, and on examination of their roots mycorrhiza were found to be lacking. A comparative study was made of the mycorrhizal and non-mycorrhizal seedlings of *P. virginiana* and the following data obtained. The average height from the root collar to bud of 20 seedlings furnished with mycorrhiza was 2·70±0·09 in. compared with 2·00±0·06 for the same number without mycorrhiza, the corresponding total numbers of short roots being 672±32 and 304±15, respectively. The average green and dry weights of samples of mycorrhizal seedlings were, respectively, 1,230±6·1 and 323±5·7mg. and for non-mycorrhizal seedlings 592±13·6 and 152±4·2 mg. The average nitrogen, phosphorus, and potassium contents per plant of the mycorrhizal series were 5·75±0·17, 0·60±0·02, and 2·17±0·07 mg., respectively, compared with 2·87±0·08, 0·15±0·004, and 0·96±0·04 mg., respectively, in the non-mycorrhizal. From these figures it is concluded that the differences in plant development were due to disparities in the amounts of available phosphorus, and that the mycorrhiza were the means of enabling the seedlings to absorb this element at a sufficiently rapid rate for normal growth [cf. *R.A.M.*, xvii, p. 698].

Rivera (V.). **Der chemische Faktor beim Parasitenbefall der Pflanzen.** [The chemical factor in the parasitic infection of plants.]—*Angew. Chem.*, li, 44, p. 775, 1938.

This is an abstract of a paper read before the Tenth International Congress of Chemistry in Rome (15th to 21st May, 1938). Although chemical factors are predominantly involved in the susceptibility of plants to fungal, bacterial, and virus infection, no general rule can be laid down concerning their operation, which varies with the individual host and pathogen [cf. *R.A.M.*, ix, p. 472 *et passim*]. Thus, in one case sugars are mainly responsible, in another nitrogen or soluble polypeptids, while the ability of the host to supply the invading organism with a sufficiency of these substances must also be taken into consideration. Cell sap acidity sometimes enhances and in other cases reduces susceptibility. In experiments cadmium, lead, barium, strontium, picric acid, and strychnine, as well as the contact metals, were shown to exert either a stimulatory or an inhibitory action on parasitic attack.

The defence mechanism of plants against invasion is frequently of a chemical nature, being sometimes connected with the presence (actual or incipient) of phenol compounds, in other cases with that of tannin, while yet again the juice of resistant plants may contain substances of which the antitoxic and bactericidal efficacy is bound to the protein portion.

Robbins (W. J.) & Kavanagh (F.). **Thiamin and growth of Pythium butleri.**—*Bull. Torrey bot. Cl.*, lxv, 7, pp. 453–461, 3 figs., 1938.

The authors state that in the light of present knowledge the fungi may be divided into at least three groups by their relation to thiamin (vitamin B_1), according to whether they are able or not to synthesize thiamin or the vitamin intermediates pyrimidin and thiazol [*R.A.M.*, xviii, p. 185], and to their growth response to the addition of thiamin or the vitamin intermediates to the culture media. The results of experiments, in which *Pythium butleri* [ibid., xvii, p. 522] was cultured in solutions of different concentrations of salts, asparagin, and dextrose, and also in the absence of organic nitrogen, showed that in the concentrated mineral salts solution containing asparagin and sugar the growth of the fungus was negligible, but was markedly increased on the addition of thiamin or pyrimidin. It was capable of unlimited growth when the salts of the solution were diluted, and the growth was also increased in this solution by the addition of thiamin or pyrimidin. In one instance the contamination of the medium by bacteria increased the growth of *P. butleri*. The fungus was further shown to be able to synthesize thiazol and smaller amounts of pyrimidin. These results are interpreted as indicating that under the conditions of the experiments the amount of thiamin formed by *P. butleri* was the factor limiting growth, and that the production of thiamin was affected by the concentration of salts in the solution. *P. butleri* differs from all the three groups of fungi mentioned above in that its rate of growth was increased by the addition of thiamin or pyrimidin independently of whether it was able or not under the conditions of the experiment to produce thiamin or the vitamin intermediates, whereas among the three groups the addition of the growth supplements is beneficial only in the case of the fungi that do not produce these substances, and does not affect or inhibits the growth of those which synthesize them.

Dorst (J. C.). **Over het kweekveld der Friesche maatschappij van landbouw te Engelum.** [On the breeding field of the Friesian Agricultural Society at Engelum.]—*Tijdschr. PlZiekt.*, xliv, 6, pp. 277–279, 1938.

Notes are given on breeding work carried out since 1921 at Engelum, Holland, against potato wart [*Synchytrium endobioticum*], and the two serious flax diseases, 'black tip' (due to the teleutospore stage of *Melampsora lini*) and 'fire' [*Pythium megalacanthum*, *Asterocystis radicis*, and other fungi: *R.A.M.*, xi, p. 182], to both of which the Concurrent variety has shown resistance. Roughly 90 per cent. of the total Dutch area under potatoes consists of the susceptible varieties, Eersteling [Duke of York], Bintje, Eigenheimer, Zeeuwsche Blaue, and Thorbecke, and their replacement by resistant strains presents a most

complex problem. In the course of propagating by asexual means a collection of potato bud mutants, some have suddenly acquired resistance to certain diseases, e.g., *Phytophthora* [*infestans*] and scab [*Actinomyces scabies*]. Judging by the results of crossing experiments, some of these mutations appear to be of an hereditary character.

Botjes (J. G. O.). **Over het phytopathologische werk op zijn bedrijf.** [On the phytopathological work on his farm.]—*Tijdschr. PlZiekt.*, xliv, 6, pp. 265–276, 1938.

In the present paper the author gives an account of studies of potato diseases carried out on his farm, situated on reclaimed marsh land at Oostwold, Holland, reference to which has been made from time to time in this *Review*.

Van Schreven (D. A.). **Over verschijnselen van boriumgebrek bij Aardappelknollen zooals deze zich openbaren op het veld.** [On boron deficiency symptoms in Potato tubers as manifested in the field.]—*Tijdschr. PlZiekt.*, xliv, 6, pp. 289–296, 2 pl., 1938. [English summary.]

Among Red Star potatoes in a field belonging to the Dutch Sugar Beet Cultivation Institute where heart rot of fodder beets was severe from 1935 to 1937, a tuber disease characterized by partial or total brown discoloration of the vascular ring was distinctly less prevalent in 1938 in plots receiving Chilean sodium nitrate (600 kg. per hect.) than in those treated with the same quantity of calcium nitrate. In a second field planted with the Industrie variety the fertilizer consisted of 1,200 kg. ultra super (20 per cent.), 1,000 kg. potash fertilizer, and 500 kg. nitrogen in various forms plus 20 kg. borax. Of 157 tubers from the former field sectioned at harvesting, 99 (63 per cent.) showed internal symptoms of disease, while of 116 from the latter only 18 (16 per cent.) were similarly affected in a comparatively mild form.

The vascular discoloration associated with absence of boron [*R.A.M.*, xvi, pp. 55, 269] is usually most pronounced at the navel ['stem'] end of the tubers, beginning at the point of insertion of the stolon. The portions of the cortex adjoining the vascular ring may participate to some extent in the darkening of the tissues, while the pith may also occasionally be involved. The area enclosed by the vascular ring may present a somewhat glazed appearance in severely affected tubers, which may emit a slight creaking sound on cutting. Moreover, the diseased tissues tend to develop a rapid discoloration on exposure to the air.

Loring (H. S.). **Properties of the latent mosaic virus protein.**—*J. biol. Chem.*, cxxvi, 2, pp. 455–478, 1 fig., 1 graph, 1938.

The results of experiments to determine the yields and relative or specific activity of the latent [potato] mosaic (X) virus obtained from *Nicotiana glutinosa* and Turkish tobacco [*R.A.M.*, xvii, p. 207], and prepared by chemical treatment and ultracentrifugation, revealed wide variations in relative activity according to the method of purification employed. In general, repeated precipitation with salt or acid produced preparations of low and variable activity, as compared with the uniform

high activity displayed by those resulting from ultracentrifugation. There were no marked differences in the properties of the active and relatively inactive preparations, both having the same qualitative solubility, serological relations, ability to traverse ultrafilters of about 450 mμ average pore diameter when dissolved in nutrient broth and 0·1 M phosphate at P_H 8·5, and capacity for the formation of liquid crystalline solutions, which are, however, more opalescent in the case of the inactive preparations and give highly diffuse boundaries in the analytical ultracentrifuge.

The analyses of virus purified by ultracentrifugation are those of a nucleoprotein containing some 6 per cent. nucleic acid. Qualitative tests and the isolation of a material with the qualitative solubility of yeast nucleic acid also point to the presence of a pentose nucleic acid. The ratio of carbohydrate to phosphorus is about twice that determined by the same analytical method for yeast nucleic acid, indicating the possible occurrence of carbohydrate in some other form as well as in combination with nucleic acid. The latent mosaic virus is relatively unstable below P_H 4, but stable from 7·5 to 9, in diametrical opposition to tobacco mosaic.

The relatively high degree of homogeneity of the virus purified by the ultracentrifugation of clarified infectious juice, as shown by its uniform specific activity and the sharp boundaries obtained in the analytical ultracentrifuge, and its ability to pass ultrafilters of 450 mμ pore diameter, are considered to indicate that such preparations, as opposed to those derived from ammonium sulphate treatment, are essentially identical with the infectious principle as it occurs in plant juice.

Black (L. M.). **Properties of the Potato yellow-dwarf virus.**—*Phytopathology*, xxviii, 12, pp. 863–874, 2 figs., 1938.

At the Rockefeller Institute for Medical Research, Princeton, New Jersey, the potato yellow dwarf virus [*R.A.M.*, xvii, p. 701] was experimentally transmitted by means of grafting or the leaf-hopper vector, *Acerotagallia sanguinolenta*, to the following plants not hitherto recorded as susceptible: *Nicotiana glutinosa*, *N. langsdorffii*, *N. sylvestris*, Semple's Shell Pink China aster (*Callistephus chinensis*), crimson clover (*Trifolium incarnatum*), broad bean, *N. rustica* (also inoculated by rubbing), *N. glauca*, *N. paniculata*, *N. sanderae*, Turkish tobacco, *Physalis pubescens*, and Black Beauty eggplant. In all cases the virus was transferred back from the new host to Green Mountain potatoes or *N. glutinosa*.

Up to 1,350 primary lesions were obtained on a single half leaf of *N. rustica* inoculated with the yellow dwarf virus from the same host, the foliage in some cases being so heavily infected that complete yellowing rapidly ensued. The English, Iowa, *jamaicensis*, *pumila*, and Winnebago varieties of *N. rustica* are all susceptible to the yellow dwarf virus, while *N. paniculata* and *N. undulata*, descendants of the probable parental species of *N. rustica*, also respond to inoculation by the development of primary lesions. In inoculation tests by the carborundrum method of leaf-rubbing *N. rustica* proved to be more susceptible to infection by the yellow dwarf virus than any of the five plants

from which the inoculum was procured, viz., potato, *N. glutinosa*, Turkish tobacco, *Hyoscyamus niger*, and crimson clover. Experiments undertaken to determine the best method of mechanical transmission in the potato showed that the most satisfactory results (50 per cent. infection) were secured by placing juice from severely diseased leaves round the eye of an unsprouted seed piece and making about 100 pin punctures through the juice into the flesh of the tuber.

The primary-lesion reaction was applied in the determination of certain properties of the virus, which was found to succumb in the juice of *N. rustica* after $2\frac{1}{2}$ to 12 hours' exposure to room temperature (23° to 27° C.) and did not survive a week's desiccation in leaves of the same host in the laboratory. It was, however, consistently recovered from infective *N. rustica* juice diluted 10^{-3} (and in one instance 10^{-5}) with phosphate buffer or healthy juice. The virus was inactivated at a temperature of about 50°. It passed through a Berkefeld W filter without loss of virulence.

Grechushnikoff [Gretschushnikoff] (A. I.). Значение систоамилазы в иммунитете Картофеля к **Phytophthora infestans De Bary.** [The significance of sistoamylase in the resistance of Potato to *Phytophthora infestans* de Bary.]—*ex* Symposium dedicated to the memory of V. N. Lubimenko, pp. 309–313, Ukr. S.S.R. Acad. Sci. Press, Kieff, 1938. [English summary.]

The results of the experiments described in this paper are stated to have again shown that the foliage of potato varieties resistant to late blight (*Phytophthora infestans*) contains considerably larger amounts of sistoamylase [*R.A.M.*, xvii, p. 551] than that of susceptible ones; in a further series, in which a highly susceptible (Early Rose) and a resistant (Smyslovski) variety were artificially infected with *P. infestans*, it was found that infection was followed by a marked drop in the sistoamylase content of both varieties, the amount of the substance being actually lower in the healthy than in the diseased areas of infected leaves. Still further experiments, carried out both in pots and in the field, demonstrated that in all the varieties of cultivated potatoes and species of wild potatoes and their hybrids that were tested, the amount of sistoamylase was highest in dry soil (20 per cent. saturated) and gradually decreased as the soil moisture was increased. The fact, however, that no infection resulted in the blight-resistant No. 8670 variety at the higher soil humidities, at which its sistoamylase content was reduced to a lower level than in Early Rose, is considered to indicate that resistance to blight is not determined by the sistoamylase factor alone.

Mills (W. R.). **The influence of maturity of Potato varieties upon their susceptibility to late blight.**—*Amer. Potato J.*, xv, 11, pp. 318–325, 1938.

The artificial inducement of maturity in five potato varieties, viz., Bliss Triumph, Green Mountain, Katahdin, Smooth Rural, and 215–34 (a cross between Evergreen and Ekishirazu), by curtailing the period of exposure to daylight from the normal 13 to 14 hours (March) to 9 failed to increase susceptibility to late blight (*Phytophthora infestans*)

[cf. *R.A.M.*, vi, p. 47; xiii, p. 724 *et passim*]. The only significant change observed was the decreased susceptibility of short-day Smooth Rural plants as compared with those receiving the normal supply of light.

Imura (J.). **On the influence of sunlight upon the lesion enlargement of the Helminthosporium disease of Rice seedlings.**—*Ann. phytopath. Soc. Japan*, viii, 3, pp. 203–211, 1938. [Japanese, with English summary.]

The writer investigated the influence of sunlight on the enlargement of *Helminthosporium* [*oryzae* = *Ophiobolus miyabeanus*: *R.A.M.*, xvii, pp. 768, 769] lesions on rice seedlings by similar methods to those already described in connexion with his studies on blast [*Piricularia oryzae*: ibid., xvii, p. 767]. In the early stages of illumination the expansion of the spots seemed to reach a maximum on the seedlings kept under the darkest conditions (covered with two sheets of black cloth) and to be least active on those in uncovered boxes or cages. At a more advanced stage the process was most intense in the medium-shaded boxes (one or two white cotton sheets). As in the case of *P. oryzae*, the growth of *O. miyabeanus* in culture media tends to be retarded by sunlight. The relation of sunlight to lesion enlargement in the late stages of *Helminthosporium* disease is shown by these experiments to be analogous to the early reaction of the blast fungus to illumination.

Bleley (F.). **Oidium heveae. Report on the 1938 outbreak of Hevea leaf-mildew.** *J. Rubb. Res. Inst Malaya*, viii, 3, pp. 232–240, 1 graph, 1938.

In contrast to previous years [*R.A.M.*, xvii, p. 414], the *Hevea* rubber trees in the southern and central districts of Malaya wintered well in 1938, owing to dry weather brought on by the north-east monsoon, and produced an excellent flush of new foliage comparatively free from mildew (*Oidium heveae*), while in the northern districts wintering was unusually late and refoliation was interrupted by heavy rains in late March and April, with the result that a very severe attack of mildew was experienced. The rapidity of this year's outbreak of mildew seemed to indicate that the fungus hibernates in the green buds of the terminal shoots. No gradual spread of infection from a focal point of a field of rubber was observed, but the disease appeared suddenly and simultaneously on all trees in that area of which the leaves were still immature.

Hastings (J. D.) & Piddlesden (J. H.). **Prevention of mould growth on sheet Rubber during storage.**—*J. Rubb. Res. Inst. Malaya*, viii, 3, pp. 250–257, 1938.

The problem of preventing mould development on stored rubber sheets [*R.A.M.*, ix, p. 337] is stated to have become particularly important since recent arrangements have permitted estates to store larger stocks of rubber during periods of low export releases. The growth of mould in storage is favoured by the following factors: residual hygroscopic serum bodies in the rubber, the packing of imperfectly dried rubber, insufficient smoke substances in the dry sheet, centres of infec-

tion, and damp storage conditions. The rubber must be packed very dry: it should, therefore, not be removed from the smoke house during wet weather or before the sun is well up, and should be packed before evening in cases thoroughly dried by the sun. Since it has been found in practice that some of the smoke substances absorbed by the rubber have a strong preservative action and that generally a deeper coloured sheet is more resistant to mould, the smoke house should be adjusted to give as dark a sheet as possible. Smoked sheets should be stored under the driest possible conditions, opened up during the day to ensure ventilation, and closed at night to exclude the damp air. Any defective sheets found at the inspection just before shipping should be reconditioned by scrubbing them in paranitrophenol solution and then drying them in the smoke house.

Paranitrophenol is recommended as the most suitable preservative for incorporation with the rubber. Soaking the freshly machined sheets in a bath of the solution, taking care that both surfaces of each sheet are thoroughly wetted, has been found in practice to be very efficient and cheaper than adding the preservative to the latex. Many estates reported bubbles and blisters on sheets resulting from paranitrophenol treatment, and the results of experiments undertaken to investigate this point confirmed the opinion that rubber was made more sensitive to heat by the addition of paranitrophenol to the latex, and also by the sodium sulphite used on many estates to avoid pre-coagulation. Sheets containing paranitrophenol and kept in hot air at 120° F. for 24 hours and then at 140° till dry showed only a few small bubbles, while those dried at 140° throughout were very badly blistered. Sheets soaked in paranitrophenol solution exhibited a similar but less pronounced sensitivity. It is concluded, therefore, that sheets containing or soaked in paranitrophenol should be dried in the smoke house at moderate temperatures, particularly at first, the disadvantage of slow drying being fully compensated by the production of a darker sheet more resistant to mould attack.

Park (M.) & Fernando (M.). **The nature of Chilli leaf-curl.** *Trop. Agriculturist*, xci, 5, pp. 263–265, 2 figs., 1938.

A leaf malformation of chilli (*Capsicum frutescens*), included under the name leaf curl [*R.A.M.*, xiii, p. 219], is described as it occurs at Peradeniya, Ceylon: the leaf blade is curled towards the abaxial side, the interveinal areas of the leaf are sometimes distorted, and a partial suppression of the lamina, especially near the petiole, may be observed, resulting in the formation of narrow strap-shaped leaves. In advanced stages of the disease the apical meristem is aborted, and the axillary buds produce clusters of minute, thickened, and brittle leaves. Severely affected plants usually do not flower, and fruits, if they appear, are truncated or curled at the stylar end. Though leaf curl has hitherto been ascribed to viruses in Ceylon, no evidence in support of this view was forthcoming, whereas diseased plants protected from insects developed normally. Whilst the possibility of a virus being implicated is not entirely excluded, the disease is thought more probably to be due to insect injury.

Bell (A. F.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas Qd, 1937–38*, pp. 41–50, 1938.

In this report [cf. *R.A.M.*, xvii, p. 66] it is stated that sugar-cane gumming disease (*Bacterium vasculorum*) as a direct economic factor is now confined to the Mulgrave Mill area in northern Queensland. With the elimination of many of the S.J. 4 canes in the originally quarantined area the intensity of the disease has greatly diminished. A slow, outward spread still occurs, however, and the growing of S.J. 4 and Clark's Seedling has, therefore, been forbidden throughout the entire mill area. Of new seedlings tested, Q.10 appears to show most promise. A wide range of plants, when artificially inoculated, are able to act as hosts to the gumming disease organism, including sweet and dent maize, sweet and grain sorghum, Sudan grass [*Sorghum sudanense*: ibid., xv, p. 211], Guinea grass [*Panicum maximum*], Para grass [*Brachiaria mutica*], *S. verticilliflorum*, elephant grass [*Typha elephantina*], and Johnson grass [*S. halepense*]. Some varieties of sorghum were highly susceptible, the stalks freely oozing gum six months after inoculation.

A serious outbreak of Fiji disease [ibid., xvii, p. 627] occurred in the Bundaberg area in January, 1938, and small outbreaks occurred near the Elliott river and in the Isis area; in the last-named P.O.J. 2878 constitutes over half the crop.

In further tests of the hot-water treatment, the causal organism of chlorotic streak [ibid., xvii, pp. 67, 345] was inactivated by exposure to a temperature as low as 45° C. Affected plants are favoured by *Aphis sacchari*, even very small diseased plants often showing heavy infestation, which is later followed by a dense growth of sooty mould [loc. cit.].

Observations indicated that both E.K. 28 and P.O.J. 2878 are susceptible to dwarf disease [ibid., xvi, p. 61].

Downy mildew [*Sclerospora sacchari*: ibid., xvii, p. 627] considerably affected plantings of P.O.J. 2878 in the Mackay district, and the further growing of this variety has been prohibited. The disease has increased on the same variety in the Bundaberg area, and to a less extent on P.O.J. 213, which is resistant to Fiji disease. As both varieties are widely grown in southern Queensland, every effort is being made to clear up the outbreak.

Rind disease (*Pleocyta sacchari*) [ibid., xvii, p. 66] was an important economic factor in a large part of Queensland during the spring of 1937. S.J. 4 in the Cairns-Mossman area, 1900 Seedling at Mackay, and P.O.J. 2878 in the Bundaberg-Isis area were particularly affected, the losses totalling some thousands of tons of cane. The different isolates showed a broad range of variation in morphology, which did not, however, appear to be associated with any difference in virulence.

The top rot stage of red stripe disease [*Bact. rubrilineans*: ibid., xvi, p. 127] was not favoured by seasonal conditions except in the Mackay district, where it caused some damage to 1900 Seedling and P.O.J. 2714. Experimental evidence indicated that Q. 2 is highly resistant, and Q. 10 and Q. 19 are reasonably so.

Leaf scald [*Bact. albilineans*: ibid., xvii, p. 487] was noticeable only in the wet, poorly drained area between the Babinda and Mulgrave

mill areas. Infection is much affected by climatic conditions, and in areas subject to recurrent droughts persists only in highly susceptible varieties.

RAYSS (T.). **Nouvelle contribution à l'étude de la mycoflore de Palestine.** [A new contribution to the study of the Palestinian mycoflora.]—*Palest. J. Bot.*, J Ser., i, 2, pp. 143–160, 6 figs., 1938.

This further critically annotated list of Palestinian fungi [*R.A.M.*, xviii, p. 204] contains three new species [with Latin diagnoses] and a number of other interesting records, of which the following may be mentioned. Club root of cabbage, kohlrabi, and cauliflower (*Plasmodiophora brassicae*) was prevalent in 1937. Cauliflower leaves were attacked in 1935 and 1937 by *Peronospora brassicae* f. *major* Săvul. & Rayss, which is characterized by conidiophores 230 to 400 by 7 to 14 μ and conidia 20 to 30 by 16 to 25 μ. *P. schachtii* occurred on beet leaves in 1937 and 1938. *P. spinaciae* was prevalent in 1935 on spinach exposed for sale in shops. *Bremia lactucae* was observed in 1937 on [wild] lettuce (*Lactuca scariola*) leaves. *Cystopus candidus* f. *brassicae nigrae* Săvul. & Rayss was observed on black mustard in 1935, *C. portulacae* on purslane (*Portulaca oleracea*) leaves and stems in 1934 and 1937, and *C. resedae* n.sp. (*C. candidus* f. *resedae* Jacz.) on living leaves of *Reseda alba* in 1938. *Medicago hispida* foliage was parasitized in 1935 by *P. săvulescui* n.sp., characterized specially by the large warts on the oospores.

LUNDELL (S.) & NANNFELDT (J. A.). **Fungi exsiccati suecici, praesertim upsalienses.** [Swedish fungi exsiccati, especially from Upsala.].—Fasc. IX–X (Nr. 401–500), 49 pp., 2 figs., 1937; XI–XII (Nr. 501–600), 38 pp., 1938; XIII–XIV (Nr. 601–700), 37 pp., Upsala, Almquist & Wiksells, 1938.

Among the species represented in these exsiccata, the labels of which are here reprinted in book form, the following may be mentioned. No. 79: *Stereum frustulatum* is accepted as the correct spelling for this species and not *S. frustulosum* [*R.A.M.*, xvii, p. 567], as there is no reason to reject the specific name *frustulata* of Systema mycologicum. No. 606: *Phragmidium mucronatum* [ibid., xviii, p. 184] is accepted as a valid name for the species commonly known as *P. subcorticium* or *P. disciflorum*. Finally under No. 680 *Torula maculicola* is considered to be immature *Fusicladium radiosum* [*Venturia tremulae*: ibid., xvii, p. 779].

NEURATH (H.) & SAUM (A. M.). **The diffusion of Tobacco mosaic virus protein in aqueous solution.**—*J. biol. Chem.*, cxxvi, 2, pp. 435–442, 2 graphs, 1938.

Diffusion measurements of the tobacco mosaic virus protein [*R.A.M.*, xviii, p. 211 and next abstracts], prepared by Stanley's chemical method [ibid., xvi, p. 211] and dissolved in 0·1 M phosphate buffer, were calculated by means of Lamm's refractometric method. The observed diffusion constant is approximately 3×10^{-8} sq. cm. per sec. in the most dilute solutions (0·2 to 0·5 per cent.). The average molecular weights computed from this value and the sedimentation constants, 200×10^{-13} and 174×10^{-13}, are about 64,800,000 and 59,000,000, respectively, corresponding to a particle size of about 14 mμ in diam. and 720 mμ in length.

Lauffer (M. A.). **The viscosity of Tobacco mosaic virus solutions.**—*J. biol. Chem.*, cxxvi, 2, pp. 443–453, 1 graph, 1938.

From measurements of the specific viscosity of tobacco mosaic virus protein with a high precision quartz viscometer, taken in conjunction with sedimentation data, the size and shape of the tobacco mosaic virus protein molecule have been estimated. Two alternate sets of values were obtained, one corresponding to rod-like particles with a molecular weight of $42{\cdot}6\times10^6$, a diameter of 12·3 mμ and a length of 430 mμ, and the other to similar particles with a molecular weight of $63{\cdot}2\times10^6$, a diameter of 11·5 mμ, and a length of 725 mμ. Both these sets of values are of the same order of magnitude as those secured from stream double refraction, diffusion, ultrafiltration, and X-ray diffraction data. In terms of a model arbitrarily selected as having the dimensions of the former set of values, it was shown that a second component, the particles of which are formed by the end-to-end association of two rod-like molecules resembling the model, should have a sedimentation constant of 202×10^{-13} as compared with 174×10^{-13} for the original. Preparations of tobacco mosaic virus protein showing double boundaries in the ultracentrifuge have components with sedimentation constants of 174×10^{-13} and 200×10^{-13}. Both viscosity and double refraction of flow of the protein were found to increase in the region of the isoelectric point (P_H 5·5 to 4·2), but the former alone falls sharply to a minimum very near this point. Viscosity decreased on the addition of electrolytes, probably on account of the electrokinetic potential of the particles.

Aggregation of purified Tobacco mosaic virus.—*Nature, Lond.*, cxlii, 3601, pp. 841–843, 1938.

In the first of three papers under this heading, H. S. Loring, M. A. Lauffer, and W. M. Stanley state that accumulated evidence seems to indicate that aggregation and decreased specific activity in purified viruses occurred as a result of the somewhat drastic chemical methods used by Stanley and others [*R.A.M.*, xviii, p. 143] for the purification of viruses. In search of new methods of purification, the authors obtained a highly purified tobacco mosaic virus by means of high-speed centrifugation in the absence of salt, and subjected to a comparative study its activity, tested on leaves of *Phaseolus vulgaris* by the half-leaf method, its stream double refraction, and its filterability, before and after purification. It was found that one sedimentation caused neither an appreciable decrease in activity nor an increase in stream double refraction, whereas four sedimentations caused a slight decrease in activity and a significant increase in stream double refraction. Virus sedimented one or four times showed the same ability to pass ultra-filters of 190 mμ average pore diameter as the virus in the original juice. These results failed to show an appreciable irreversible aggregation as a result of centrifugation, and indicated that tobacco mosaic virus purified by a few careful centrifugations is comparable in the three properties studied to the virus in untreated juice.

F. C. Bawden and N. W. Pirie point out that even if centrifugation does not cause aggregation, completely unaggregated preparations could be expected only from plants that have been recently infected,

for aggregation occurs naturally in the sap of plants that have been long diseased. They suggest that until adequate data on the properties of virus preparations made by high-speed centrifugation have been published, their purity cannot possibly be assessed.

K. M. Smith and W. D. MacClement see no justification for the view that the virus is not aggregated merely because it passes a membrane of 190 mμ average pore diameter. They point out that the accepted ultrafiltration end point of tobacco mosaic virus in crude clarified sap is about 50 mμ; in their own experiments the end point of the virus, after precipitation at P_H 3·4, was found under optimum conditions to be 150 to 175 mμ; and finally a highly purified tobacco mosaic virus, capable of entering the liquid crystalline state, has an end point greater than 450 mμ. It is evident, therefore, that intermediate stages of aggregation are possible.

Lauffer (M. A.). **Optical properties of solutions of Tobacco mosaic virus protein.**—*J. phys. Chem.*, xlii, 7, pp. 935–944, 4 figs., 1 diag., 1 graph, 1938.

Dilute aqueous solutions of the tobacco mosaic virus protein have been known for some time to exhibit double refraction of flow [see preceding abstracts]. The results of the present experiments show that little or no stream double refraction is obtained from the protein in solvents having a refractive index approximating to that of the protein itself (1·6), e.g., glycerol-water and aniline-glycerol-water mixtures. A slight decrease in virus activity, measured by the half-leaf method on *Phaseolus vulgaris*, was caused by a week's contact of a 10^{-6} mg. per c.c. dilution with glycerol (90 per cent.), but no significant change in activity resulted from ten minutes' contact with water or aniline.

Ultracentrifuged gelatinous pellets of the protein were shown to have properties characteristic of the liquid crystalline or paracrystalline state, a fact regarded as constituting additional evidence of the rod-like character of the mosaic virus [*R.A.M.*, xviii, p. 62]. A photomicrograph of a flattened section of such a pellet is stated to resemble substances of a known crystalline or paracrystalline nature, e.g., bromophenanthrenesulfonic acid.

The Tyndall effect of the upper of the two layers into which relatively concentrated solutions of the protein separate on standing was found to differ markedly from that of the lower. In the upper the scattered light is only slightly depolarized, whereas in the latter the degree of depolarization is much more advanced.

All these data are considered to be consistent with the conclusion that the tobacco mosaic virus protein particles or molecules are rod-shaped nucleoproteins with little or no intrinsic double refraction, in respect of which they differ markedly from the sperm cells of the cuttle-fish and cells of other living organisms having the property of double refraction or paracrystallinity.

Martin (L. F.) & McKinney (H. H.). **Tobacco-mosaic virus concentrated in the cytoplasm.**—*Science*, N.S., lxxxviii, 2289, pp. 458–459, 1938.

The vacuole sap extracted by Chibnall's method of hydraulic pressure

(*J. biol. Chem.*, lv, p. 333, 1923) from mosaic-infected Maryland Medium tobacco leaves contained a very small amount of protein after filtration through celite. The protein was partially insoluble in 0·5 saturated ammonium sulphate and precipitated by trichloro-acetic acid. The 45 c.c. of vacuolar sap contained 0·317 mg. per c.c. of total nitrogen, and only 0·022 mg. per c.c. of protein nitrogen. Most of the protein was in the 78 c.c. of cytoplasmic extract, which contained 0·583 mg. per c.c. of total nitrogen, and 0·389 mg. per c.c. of protein nitrogen. On this basis the vacuolar sap and the cytoplasmic extract contained, respectively, 0·13 and 2·36 mg. per c.c. of protein. In inoculation experiments on primary Scotia bean (*Phaseolus vulgaris*) leaves, the vacuolar sap and the cytoplasmic extract of the mosaic tobacco foliage, diluted to a uniform protein content of 10^{-4} mg. protein per ml. in a phosphate buffer at P_H 7, induced 1 and 240 lesions, respectively, the corresponding number for a control preparation of highly purified virus protein being 222 (32 leaves each). It is evident from these data that the protein in the vacuolar sap is chiefly a non-infectious form, and it appears probable that part or all of the trace of virus in this fraction represents contamination from the cytoplasm during pressure. The mosaic virus being thus obviously localized in the cytoplasm, Livingston's theory of its passage from cell to cell through the plasmodesmata seems plausible [cf. *R.A.M.*, xvi, p. 67].

WICKENS (G. M.). **Rosette disease of Tobacco: field observations and suggestions for control.**—*Rhod. agric. J.*, xxxv, 11, pp. 842–849, 1 fig., 1938.

The rosette disease of tobacco recently reported from Southern Rhodesia [*R.A.M.*, xvii, p. 565] shows two phases of infection in the field. These are a localized phase, in which small groups of affected plants are scattered about the fields, and an epidemic phase, in which infection is generally distributed.

The available evidence indicates that some wild or garden plant probably harbours the virus during winter, and that the vector (? *Myzus persicae*) picks up the virus from these plants and infects the tobacco in the following season. From these sources of infection the disease spreads generally too slowly to cause any great damage. The localized phase appears to have been common in most of the tobacco-growing areas of Southern Rhodesia, all instances of severe epidemics except one being in late-planted crops. It is assumed that the localized phase results from transmission by wingless aphids, which crawl from plant to plant, and the epidemic phase from widespread dissemination of winged, infective aphids.

It is considered that the disease should be regarded as a real danger, and growers are strongly advised to adopt the following control measures. As transmission experiments have proved seedlings to be highly susceptible, seed-beds should be frequently examined; if aphids only are present, a nicotine spray should be applied, while if rosette is present as well, every plant and aphid should be promptly destroyed. If the bed cannot be spared, the affected seedlings with the aphids attached should be removed, and destroyed, the remaining seedlings then being sprayed with nicotine; further roguing and spraying must later be

carried out as required. Frequent roguing should also be carried out during the early stages of growth. As soon as possible after all leaves of value are reaped, the infected plants should be removed and destroyed. Where possible, nicotine spraying or dusting of small areas of local aphid infestation should be attempted immediately after the removal of the affected plants.

VAN DER POEL (J.). **Kort overzicht van het slijmziekte-vraagstuk bij de Deli-Tabak.** [A brief survey of the slime disease problem in Deli Tobacco.]—*Meded. Deli-Proefst.*, Ser. 2, ii, pp. 5–16, 1939. [Issued 1938.]

This is a summary of outstanding contributions to the knowledge of slime disease of tobacco (*Bacterium solanacearum*) under various aspects, including bacteriological studies, breeding for resistance, and the influence of environmental conditions on the pathogen, with special reference to the experiments in its control in continuous progress at the Deli (Sumatra) Experiment Station [*R.A.M.*, xvii, p. 632].

MUSHIN (ROSE). **Studies in the physiology of plant pathogenic bacteria. The food requirements of a xylem invader, Bacterium solanacearum E.F.S., and of a phloem invader, Aplanobacter michiganense E.F.S.**—*Aust. J. exp. Biol. med. Sci.*, xvi, 4, pp. 323–329, 1938.

A tabulated account is given of studies on the nutritional requirements on synthetic media of *Bacterium solanacearum*, isolated from diseased potatoes and tomatoes in Victoria [*R.A.M.*, xvii, p. 302], and of *Aplanobacter michiganense*, obtained from a stock culture also originating on tomatoes in Victoria [ibid., xvi, p. 214]. *Bact. solanacearum* utilized asparagin, peptone, tyrosine, and glutamic acid as sources both of carbon and nitrogen, while the former was also supplied by glucose, sucrose, glycerol, and sodium citrate and the latter by ammonia and potassium nitrate. Of all the experimental compounds furnished, only peptone was assimilated by *A. michiganense*.

Considerable variations in the morphology of *Bact. solanacearum* were observed. Fresh isolations from host plants consisted of Gram-negative coccobacilli, 0·4 to 0·8 by 0·3 μ, often occurring in pairs. On transference to another agar plate the rods elongated (1 by 0·5 μ), thickened, acquired rounded ends, and frequently appeared in pairs as large rods with a median constriction. On transference to broth the coccobacillus type developed once more. Long, slender filaments, composed of 10 to 20 cells, 1·2 by 0·5 μ, were frequently formed by the organism on subculturing from liquid media on to agar slopes. *A. michiganense* occurred in the form of single, Gram-positive rods, 1 by 0·4 μ.

Unlike Smith's strain, the Victorian isolation of *Bact. solanacearum* produced acid in glucose and a small quantity after several weeks in galactose. The strain of *A. michiganense* used in the tests formed small amounts of acid from glucose, saccharose, and salicin after a lengthy incubation period. Four months after isolation the culture of *Bact. solanacearum* was successfully reinoculated into two tomato plants, the exceptionally long retention of pathogenicity by the organism

being attributed to the rapid subculturing practised during the experiments.

Visocchi (V.). **La ticchiolatura del Pomodoro.** [Tomato leaf mould.]—*Ital. agric.*, lxxv, 10, pp. 648–689, 1938.

Tomato leaf mould (*Cladosporium fulvum*) attracted no particular attention in Italy until recent years, when reports of serious losses from this source were received from various localities. In this connexion a summary is given of some outstanding contributions by investigators in other countries.

Kienholz (R.) & Bidwell (C. B.). **A survey of diseases and defects in Connecticut forests.**—*Bull. Conn. agric. Exp. Sta.*, 412, pp. 493–559, 1 fig., 18 graphs, 2 maps, 1938.

A field survey of diseases and defects in Connecticut forests carried out from 1934 to 1936 showed that cankers caused by *Nectria coccinea* [*R.A.M.*, xvi, p. 645] and other *N.* spp. [ibid., xvii, p. 419], were the most prevalent form of defect. These cankers were found on 5·8 per cent. of all the trees (over 98,000 trees examined). Of the different species examined, birches, maples, and oaks showed, respectively, 12·5, 6·1, and 3·6 per cent. infection. So-called 'weed' species, such as mountain maple (*Acer spicatum*), were frequently infected; these may serve as a source of infection for more valuable trees, and should, if possible, be removed. In oaks, maples, and birches, 97, 86, and 51 per cent. of the cankers were situated on the main trunk within 8 ft. of the ground. Only 4·8 per cent. of the affected trees bore cankers on the branches. The average number of cankers per tree, all species, amounted to 2·9. Of the cankers found, 84 per cent. were not fruiting, 5 per cent. were fruiting sparsely, and 11 per cent. were fruiting abundantly. Many of the cankers appeared to have arisen through entry of the fungus into old branch stubs, others being associated with borer injury, frost cracks, rubs, and mechanical injuries. The evidence indicated that in birches particularly *Nectria* canker may cause death; oaks appeared to succumb if infected when young, but maples seemed to be able to outgrow infection. To the list of infected genera given by Welch [ibid., xiii, p. 732] the present study adds *Cornus*, *Alnus*, *Hamamelis*, *Salix*, and *Platanus*.

Cankers due to *Strumella corynoidea* [ibid., xvii, p. 83] were found on 0·2 per cent. of the total stand, and 0·6 per cent. of all the oaks examined, 69 per cent. of the cankers being within 8 ft. of the ground.

Of the living trees examined, 3·1 per cent. showed decay, the most common fruiting decay being due to *Fomes connatus* [ibid., xvii, p. 213], which was responsible for about three-fourths of all the named decays. Red maple (*Acer rubrum*) was most frequently infected. The second most prevalent fungus was *F. nigricans* [*F. fomentarius*: ibid., xviii, p. 214], which accounted for 13 per cent. of the named decays. Other fungi found were *Daedalea quercina*, *Armillaria mellea*, *Polyporus hispidus* [ibid., xviii, p. 69], *F. igniarius* [ibid., xviii, p. 214], *F. applanatus* [*Ganoderma applanatum*], *F. fomentarius*, and *F. fraxinophilus* [ibid., xviii, p. 69]. Cull due to visible decay was 4 and 0·6 per cent., respectively, of the small and large tree populations.

Strong (F. C.). **Prevalence of wilt diseases in Maple and Elm.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxi, 2, pp. 96–99, 1938.

In the United States wilt symptoms are produced on elms by *Ceratostomella ulmi*, *Verticillium* sp. [cf. *V. rhizophagum*: *R.A.M.*, xvi, p. 142], *Dothiorella ulmicola* (formerly known as *Cephalosporium* sp.) [? *D. ulmi*: ibid., xvi, p. 782], and species of *Sphaeropsis*, *Coniothyrium*, and *Vermicularia*. The only parasitic fungus known to cause maple wilt is an unidentified species of *Verticillium* [ibid., xv, p. 693] which also infects elm, Japanese barberry [*Berberis japonica*], and other ornamental shrubs.

A careful laboratory study of 51 cases of dying American elms from different parts of Michigan revealed that 31 per cent. of the trees were affected by *Verticillium* wilt, 5 per cent. with *D. ulmi*, 2 per cent. with *Coniothyrium*, and 2 per cent. with *Sphaeropsis* canker, while in 41 per cent. no fungus was present and the wilting was attributed to non-parasitic agency. So far, *Ceratostomella ulmi* has not been detected in Michigan. Of 53 cases of maple wilt examined, 20 were due to *Verticillium* and the remainder to non-parasitic causes. Of the fungal infections, 90 per cent. were on Norway maple [*Acer platanoides*] and only 10 per cent. on hard maples. The paper terminates with brief notes on control.

Ray (W. W.). **Overwintering of Taphrina robinsoniana.**—*Phytopathology*, xxviii, 12, pp. 919–922, 1 fig., 1938.

Histological studies in 1936 of the bracts of dormant female alder (*Alnus incana*) catkins in New York State failed to disclose the presence of perennial mycelium of *Taphrina robinsoniana*, additional evidence in favour of the absence of which was afforded in 1937 by the reduction of infection on six young trees from between 90 and 100 to 19 per cent. as a result of two applications of 1 in 40 lime-sulphur. The conclusion that the mycelium plays no part in the perpetuation of the fungus was still further strengthened by experiments in which female catkin clusters, enclosed in transparent, waterproof bags, reached maturity without contracting infection. Spores of *T. robinsoniana* on potato dextrose agar plates remained viable from July to the following January at 27° C. and till March at 24°, indicating the probability of survival of these organs in nature from September until the period of spring infection under normal conditions.

Liernur (A. G. M.). **Heksenbezemvorming op Linde.** [Witches' broom formation on Lime.]—*Tijdschr. PlZiekt.*, xliv, 6, pp. 307–308, 2 figs., 1938.

In 1937 the writer inspected a lime [*Tilia*] tree in a Breda (Holland) nursery, the crown of which consisted of a multiplicity of short branches arising from adventitious buds. The case is presumably to be classed in the category of witches' brooms of non-parasitic origin [cf. *R.A.M.*, vi, p. 706].

De Haan (I.). **De Ceratophorum-bladziekte van jonge Albizzia planten.** [The *Ceratophorum* leaf disease of young *Albizzia* plants.]—*Arch. Theecult. Ned.-Ind.*, xii, 4, pp. 303–309, 6 figs., 1938. [English summary.]

Particulars are given of a leaf disease of *Albizzia falcata* and *A. sumatrana*

seedlings in West Java nurseries caused by *Ceratophorum albizziae*, which produces on the leaves circular, yellowish-brown spots, 1 to 1·5 mm. in diameter, surrounded by a dark green margin. The fungus was isolated from the diseased tissues and grown on various culture media, of which sterilized leaves of the host proved to be the most suitable for the development of the characteristic conidia (50 by 12 μ); on plum agar these organs are replaced by dirty brown chlamydospores. Inoculation experiments with fragments of the *Albizzia* leaf cultures on healthy seedlings in a humid atmosphere gave positive results.

Infection by *C. albizziae* was observed to be most prevalent in the Buitenzorg district following nights with heavy dew but without rain at the end of May and early June. In order to outgrow the attacks of the fungus the plants must have reached a height of over 30 cm., and the time of sowing in November should therefore be calculated accordingly. Another measure tending to reduce the incidence of the disease is the interplanting of the *Albizzia* seedlings with the immune lamtoro [*Leucaena glauca*]. A severe epidemic of the leaf blight over an extensive area was successfully combated by repeated applications at 7- to 10-day intervals from the beginning of June till the middle of October of Bordeaux mixture [concentration not stated] or nosperit plus 0·5 per cent. glue.

Wharton (W. P.). **Are the Elms being saved?**—*Amer. Forests*, xliv, 12, pp. 545–547, 2 figs., 1 map, 1938.

The writer, as chairman of a national conference on Dutch elm disease [*Ceratostomella ulmi*] eradication, is of opinion that the present methods employed by the United States Government in dealing with the urgent work of control [*R.A.M.*, xviii, p. 70] are totally inadequate, and he is supported in these views by J. H. Faull and J. C. Boyce, a summary of whose recent joint field study of the campaign is quoted. Among other things, the indiscriminate recruitment, under the unemployment relief scheme of the Works Progress Administration, of untrained men for the highly skilled work of disease detection is regarded as a mistaken policy.

Day (W. R.). **Root-rot of Sweet Chestnut and Beech caused by species of Phytophthora. I. Cause and symptoms of disease: its relation to soil conditions.**—*Forestry*, xii, 2, pp. 101–116, 1938.

Root rot (ink disease) of sweet chestnut (*Castanea sativa*), first observed in the New Forest in 1931 [*R.A.M.*, xv, p. 325], has been found to be due to *Phytophthora cambivora* [ibid., xviii, p. 70]. This fungus was also present quite commonly on beech. Furthermore, *P. cinnamomi* has been isolated from affected roots of sweet chestnut and *P. syringae* from root-rotted beech. The fungi attack the root, usually near the collar, spreading along the roots and a short distance up the trunk, and living mainly in the cambium and the inner cortex. According to field evidence the parasites do not depend upon wounds for successful infection, but in inoculation experiments the removal of the cork layer proved essential for positive results. On sweet chestnut the infection may spread very rapidly, the trees becoming girdled at the collar, the leaves, especially those on the top of the tree, wilting, and even very large trees dying within the first year of the disease. Chestnut trees

affected by the slower forms of the disease either produce very dwarfed leaves and flowers in the next year and then die, or (and this applies also to beech trees) show early yellowing and subsequent browning but not appreciable dwarfing of the leaves, and exude a fluid from dead or dying bark at the base of the trunk, this latter symptom being, however, quite commonly absent. Such trees either die after several years or may recover. Blue-black staining of the bark has been observed only with chestnut, and the name *Phytophthora* root rot is therefore proposed as a better general term than 'ink disease'. It was found almost impossible to isolate the fungi from dead or dark discoloured bark, but from lighter brown bark not yet killed by the parasites they were isolated with ease. Beech trees were often observed to die-back on shallow chalk soil, frequently showing symptoms similar to *Phytophthora* root rot, but no *Phytophthora* was isolated from such trees; and the chlorotic foliage frequently associated with this condition, but not observed in *Phytophthora* root rot, seems to point to a deficiency disease.

An examination of several soil profiles in diseased and healthy woods in England showed that severe attacks of the disease always occur on shallow, heavy, or compact soils with impeded drainage in the subsoil. It is suggested that the conditions which accompany impeded drainage may possibly predispose the host to attack by inducing in it a state of debility. In discussing the control of the disease, the author suggests that susceptible species should be planted only on dry and well-drained soils. Field observations confirmed the conclusion that chestnut coppice should be kept to the more fertile and sufficiently dry soils, as continued and frequent cropping of acid and moderately fertile soils with a tendency to compactness and poor drainage may result in a serious depletion of fertility and in increased impedance of drainage.

Beech is stated to be less susceptible to infection than sweet chestnut, remaining unaffected in areas where many sweet chestnuts have died. No epidemic outbreaks of infection have yet been known to occur on beech.

JONES (W. NEILSON). **On the occurrence of needle fusion in Pines in the south of England.**—*Emp. For. J.*, xvii, 2, pp. 244–246, 1938.

So far as is known at present, the only station where needle fusion of pine trees [*R.A.M.*, xvii, p. 444] has been observed in a typical form in Great Britain is on a small area of the Forestry Commission plantations near Wareham, Dorset. The soil in this locality is poor, sandy, gravelly, of very low mineral content, and very infertile. The affected species are *Pinus radiata* and *P. contorta*, and the symptoms are similar to but more marked than those noted in Australia. In some stands, 90 per cent. of the trees are probably affected; no recovery has occurred in the field, and in many instances death has ensued. Affected trees developed symptoms with great suddenness, whereas others in close proximity sometimes remained apparently healthy. Mycorrhiza were present in the affected trees but none appeared to be developed in the current season. Experimental evidence demonstrated that progressive recovery followed re-potting in good humus soil. Spectral analysis showed that the leaves of affected trees has a consistently lower boron content than the leaves of healthy trees but, so far, applications of boron or zinc have not given conclusive results.

Hepting (G. H.) & Chapman (A. D.). **Losses from heart rot in two Shortleaf and Loblolly Pine stands.**—*J. For.*, xxxvi, 12, 1193–1201, 1938.

A tabulated account is given of investigations on the etiology, extent, and economic importance of decay in a young stand of shortleaf and loblolly pines [*Pinus echinata* and *P. taeda*] in southern Arkansas and in an older stand of the former species only in eastern Texas. Most of the rot was found to be of the red-heart type, caused by *Fomes pini* [*R.A.M.*, xvii, p. 214] (40·4 out of a total of 51·1 per cent. in Arkansas loblolly, 19 out of 25·5 per cent. in Arkansas shortleaf, and 30·9 out of 37·3 per cent. in Texas shortleaf); the corresponding figures for butt rots due to *Polyporus schweinitzii* [ibid., xviii, p. 4], entering principally through fire wounds, were 1·2, 1·3, and 11·2 per cent., respectively. The cull percentages attributable to fungal rotting for Arkansas loblolly were 1·16 board ft. log scale, 0·12 cu. ft. log scale, and 1·20 on a lumber tally basis, the corresponding figures for Arkansas and Texas shortleaf being 0·23, 0·06, and 0·30 and 2·43, 1·33, and 1·77, respectively. The volume loss from rot in the infected Arkansas logs was 3·9 per cent., lumber tally basis, representing a financial loss of 7·9 per cent., the corresponding figures for Texas being 7 and 11·3 per cent., respectively.

Garren (K. M.). **Studies on Polyporus abietinus. II. The utilization of cellulose and lignin by the fungus.**—*Phytopathology*, xxviii, 12, pp. 875–878, 1938.

In further studies on *Polyporus* [*Polystictus*] *abietinus* [*R.A.M.*, xviii, p. 219] the capacity of the fungus for the utilization of cellulose and lignin in culture was tested, 2·5 per cent. of each constituent being added to a stock mineral agar medium. Cellulose proved to be superior to lignin as a source of nutrient, though the latter was also assimilated in sufficient quantities to permit of sparse growth, especially in the presence of 1 per cent. ammonium nitrate. When 0·5 per cent. tannic acid was incorporated in the medium, *P. abietinus* made good growth and developed a brown halo, indicating the formation of laccase, which probably catalyses the oxidation of the phenolic groups in lignin and so causes its partial decomposition. The production of a brown halo on a tannic acid medium in the Bavendamm test [ibid., vii, p. 68] need not be interpreted as showing that the fungus utilizes lignin alone, as the author's experiments show that both cellulose and lignin can be utilized by *P. abietinus*.

Toole (E. R.). **Relative durability of Black Locust and Shipmast Locust when subjected to four wood decay fungi.**—*J. For.*, xxxvi, 11, pp. 1120–1122, 1938.

The wood of shipmast locust [*Robinia pseud-acacia* var. *rectissima*] has long been regarded as more durable in service than that of the common black locust [*R. pseud-acacia*], and the results of recent laboratory tests have been interpreted as supporting this observation [*R.A.M.*, xvii, p. 635]. The data in question have been subjected by the author at the Duke School of Forestry [North Carolina] to an analysis of variance, and found to be significant only for two of the four fungi used in

the tests, *Poria incrassata* [see next abstract] and *Fomes rimosus*, differences between the two varieties in their reaction to *Polyporus robiniophilus* and *F. igniarius* having no practical importance.

HUBERT (E. E.). **The preservative treatment of millwork.**—*Industr. Engng Chem.*, xxx, 11, pp. 1241–1250, 4 figs., 1938.

One of the projects conducted in the Research Laboratory of the Western Pine Association in 1935 was a study of the possibilities of control of stain and decay in finished wood products, such as sashes, doors, frames, porch columns, and other types of millwork [*R.A.M.*, xvii, p. 782] liable to protracted exposure to moisture. It was obvious from the outset that this problem presented several new angles, and a full account is here given of laboratory experiments on the evaluation of toxicity, volatility, and leaching out in 25 chemicals and 18 proprietary wood preservatives, all of which were tested over a 60-day period on thin cross-sections of sapwood pine (*Pinus ponderosa*) to ensure rapid fungal development. Toxicity to *Lenzites trabea* [ibid. xvii, p. 783; xviii, p. 221], the principal agent of sash and door decay (over 70 per cent.), was determined both in the wood and in agar cultures, volatility by the watch-glass and Kolle flask methods, and leaching out by Arnold and Boller's practice of alternate drying and wetting [ibid., xvi, p. 79].

Besides *L. trabea*, the sapwood samples (mostly of *P. ponderosa*, but also including Idaho white pine [*P. monticola*], sugar pine [*P. lambertiana*], Douglas fir [*Pseudotsuga taxifolia*], redwood [*Sequoia sempervirens*], and western red cedar [*Thuja plicata*]), yielded *L. sepiaria*, *Trametes serialis* [ibid., xviii, p. 76], *Poria vaillantii* [ibid., xviii, p. 221], and *P. incrassata* [ibid., xvii, p. 786]. *L. trabea* is stated to have been recently isolated from a decayed sash sent from Bermuda, and to be capable of developing in wood at temperatures up to or exceeding 40° C., besides resisting treatment by a number of the better-known preservatives. Among the blue-staining organisms found in the sapwood or on the paint coatings of sashes and doors were *Pullularia pullulans* [ibid., xviii, p. 217], *Cladosporium herbarum*, *Hormiscium gelatinosum*, and *Discula pinicola* [ibid., xvi, p. 574], all of which likewise proved refractory to control by standard methods.

The three chemicals selected from nine of the most promising tested as particularly suitable for commercial use, namely, pentachlorophenol, tetrachlorophenol, and 2-chloro-*o*-phenyl-phenol, have been grouped under the name permatol D [cf. ibid., xvi, p. 148]; the average ratings of these compounds (based on toxicity, volatility, and permanence tests and cost) were 96·3, 87, and 82·1 per cent., respectively. Of the proprietary preparations tested, C 8, C 18, C 11, and C 16 were the most satisfactory, with ratings of 85, 86·8, 82·8, and 90 per cent., respectively. Amsco special solvent (Ohio Mineral Spirits Co.) and eocene were selected for use in these tests as a penetrant and spreader, respectively, from a number of other acceptable petroleum products investigated.

The requisite properties of wood species suitable for millwork and specifications for the effective treatment of the same are set forth in detail.

Van Wyk (J. H.) & Verwoerd (L.). **The toxicity of South African creosote.**—*J. S. Afr. For. Ass., 1938*, 1, pp. 47–50, 1938.

The toxicity of the creosote produced at the Iscor Works, Pretoria, was determined by a gravimetric method, in which the weight of creosote present in 1 cu.m. of wood that will restrict the loss of weight occasioned by fungus infection to 5 per cent. or less is adopted as a practicable criterion of toxicity. The losses in weight corresponding to progressively intensive impregnation were recorded and the toxic limits were considered as being bracketed within the pair of consecutive absorptions between which a 5 per cent. loss of weight occurs. The impregnation of the test blocks of *Pinus patula* from the Northern Transvaal was carried out in a glass cylinder under vacuum at 19° C., and the treated blocks then exposed in flasks to cultures of *Coniophora cerebella* [*C. puteana*] for a period of 13 weeks at a constant temperature of 25°. The results for three series of blocks showed the toxic limit of the Iscor creosote (toxicity kg./cu.m.) to be 2·95–5·29, 1·13–2·92, and 1·19–2·83, respectively, thus having a somewhat higher toxic value than the German and American creosotes, which are assessed by various investigators with toxic limits between from 2·3–3·4 to 5·4–9·2 and 6·1–9·7 to 9·0–11·3, respectively.

Tompkins (C. M.). **Charcoal rot of Sugar Beet.**—*Hilgardia*, xii, 1, pp. 75–81, 4 figs., 1938.

Charcoal rot of sugar beet caused by *Macrophomina phaseoli* [*R.A.M.*, xiv, p. 670] is reported to have been found in 1932 in the hot interior valleys of California, the incidence of infection ranging from 8 to 30 per cent. The fungus attacked half-grown and mature beets during the hot season and caused a wilting and eventual dying-off of the foliage, the dead leaves remaining firmly attached to the crowns. Externally the infection is usually confined to the crown region, where brownish-black lesions of irregular shape and size and with a silvery sheen are formed. On old lesions the periderm is very thin, papery, and loosely attached to the underlying tissues, cracking under slight pressure and exposing dry, black, carbonaceous masses of sclerotia. In cross section the advancing margin of a lesion is mustard-yellow but later turns a buffy citrine. Once the entire root is invaded the tissues become old gold in colour and finally brownish-black. In the late stages of decay, masses of black sclerotia largely displace the periderm and parenchymatous tissues, eventually occupying the pith so that only the vascular elements retain their identity. Completely invaded beets shrink and tend to become mummified.

Infection of sugar beet roots and seedlings was obtained in the laboratory with different isolates of the fungus from sugar beet and with isolates from bean, *Begonia tuberhybrida*, cotton, strawberry, and sweet potato. The optimum temperature for growth of one of the isolates from sugar beet was shown to be approximately 31° C. The diameter of the sclerotia ranged from 46·2 to 146·3 μ (mean 73·8 to 87·2 μ) and the fungus thus belongs to Haigh's C group (*M. phaseoli*) [ibid., ix, p. 685] though no isolate from sugar beet has yet produced pycnidia.

Claus (E.). **Die Zuckerrübenzüchtung von heute.** [Sugar Beet breeding to-day.]—*Zbl. Zuckerindustr.*, xlvi, 41, pp. 905–909, 1938.

Among the foremost problems of modern sugar beet breeding is the development of disease-resistant varieties, and a brief account is given of work in progress in this direction at Quedlinburg, Germany. Resistance to curly top [*R.A.M.*, xviii, p. 150] in American selections is stated to be combined with a strong tendency to 'bolting' and a relatively low sugar content. In a recent test the sugar content of the Gebr. Dippe selection Z amounted to 22·12 per cent. as compared with 19·22 per cent. in the American strain, the corresponding figures for 'bolting' being 0·6 and 5·7 per cent., respectively. Curly top is of interest to German growers on account of its similarity to crinkle [ibid., xvii, p. 642], the incidence of which has been experimentally reduced by 20 to 30 per cent. As regards leaf spot (*Cercospora*) [*beticola*: ibid., xviii, p. 6], observations in Spain have demonstrated a correlation between resistance and a non-leafy growth habit coupled with a high sugar content.

Decoux (L.) & Roland (G.). **Atlas des ennemis et maladies de la Betterave.** [An atlas of the pests and diseases of the Beetroot.]—56 pp., 20 col. pl., Brussels, A. & G. Bulens Frères, 1938. 30 Belgian fr.

This useful little book, intended as a practical guide for growers, contains brief notes in popular terms on the symptoms, causes, and control of the principal fungal, bacterial, physiological, and virus diseases, and insect pests of sugar beets found in Belgium. The work is illustrated by a number of excellent coloured plates, giving the popular names of the diseases in French, Flemish, German, and English as well as the causal organism (where present) in Latin. It is stated that during 1936 the loss sustained from virus yellows [*R.A.M.*, xviii, p. 79] in the provinces of Hainaut and Flanders, over an area of 18,000 hect., is estimated at 25,000,000 fr. [nearly £4 per acre].

Osborn (H. T.). **Studies on Pea virus 1.**—*Phytopathology*, xxviii, 12, pp. 923–934, 1 fig., 1938.

Pea virus 1 [*R.A.M.*, xviii, p. 150], difficult to transmit by the ordinary rubbing method, is communicable from diseased to healthy plants by the carborundum powder technique. However, sub-inoculation from mechanically infected plants to broad beans, both by means of aphids (*Macrosiphum pisi* and *M. solanifolii*) and rubbing, was found to produce much less satisfactory results than from insect-infected plants: in the former case failure generally ensued when the transfers were made less than 24 days after the original inoculation, while in the latter a three-day period sufficed for the multiplication of the infective principle. The virus was carried through four serial passages by mechanical inoculation in broad beans, at the close of which sub-inoculation was even more difficult than at first.

Pea virus 1 resisted ten minutes' heating *in vitro* at various temperatures from 52° to 64°, but succumbed at 66° C. It was destroyed by five but not by four days' ageing *in vitro* and by dilution to 10^{-4} but

not 10^{-3}. The virus was retained by aphids for periods up to eight days when they were transferred from diseased to a succession of healthy plants at 35°.

In addition to the original New York strain of the virus used in these experiments, a similar one from New Jersey was tested and found to differ slightly from the first both in symptomatology and ease of mechanical inoculation. On broad bean the initial signs of infection by the New Jersey strain consist of crinkling, distortion, and necrotic lesions on the leaves; later the large, yellow spots may be difficult to distinguish from those due to the New York strain. On crimson clover (*Trifolium incarnatum*) the New Jersey strain may be differentiated from the New York form by its tendency to cause necrotic spotting of the foliage. In mechanical inoculation tests on broad bean only nine out of 50 plants infected by the New Jersey strain developed the symptoms of pea virus 1 compared with 36 when New York inoculum was used.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, 11, pp. 608–612, 4 figs., 1938.

Bean [*Phaseolus vulgaris*] mosaic [*R.A.M.*, xvii, pp. 585, 716] is one of the most prevalent diseases of this crop in New South Wales, where it frequently causes heavy loss. Infection is carried over from season to season and spread from one locality to another by diseased seed. The condition is generally most prevalent in late spring and early summer, and its seriousness is strongly influenced by date of planting. None of the locally cultivated varieties of dwarf French beans displays any marked resistance [ibid., xvii, pp. 369, 646], but the pale varieties, Epicure and Kentucky Wonder, are moderately resistant. Until resistant varieties of good quality are available, control depends upon the use of clean seed. Crops should be planted as late as possible.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xii, 12, pp. 269 M–270 M, 1938.

Algeria. Citrus- and cotton-growers of Algeria are required by Decrees of the President of the French Republic, dated 17th June, 1938, to join local associations (grouped into a compulsory union) for the organization and improvement of disease control. In the case of cotton, cultivation is permitted only within certain recognized areas, the limits of which are defined or modified by Decree of the Governor-General of Algeria.

Government Notice No. 11. The Plant Protection Decree, 1937. The Plant Protection (Importation of Pineapples) Order, 1938.—*Off. Gaz. Zanzibar Govt. Legal Suppl.* (Part II), xlvii, 2470, 1 p., 1938. [Mimeographed.]

By the Plant Protection (Importation of Pineapples) Order, 1938, the importation into Zanzibar of pineapple plants, fruits, or parts is prohibited except under written permit issued by the Director of Agriculture.